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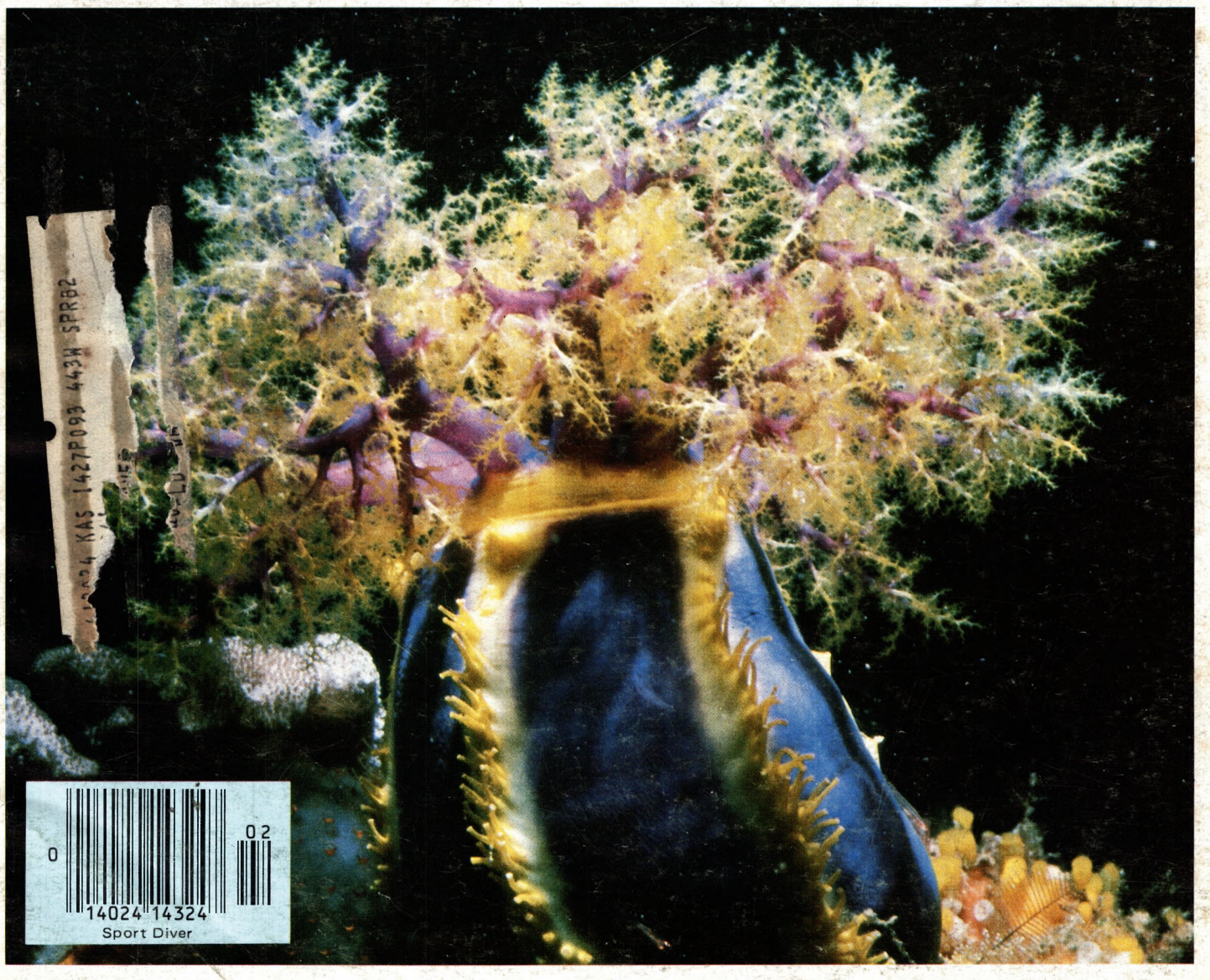
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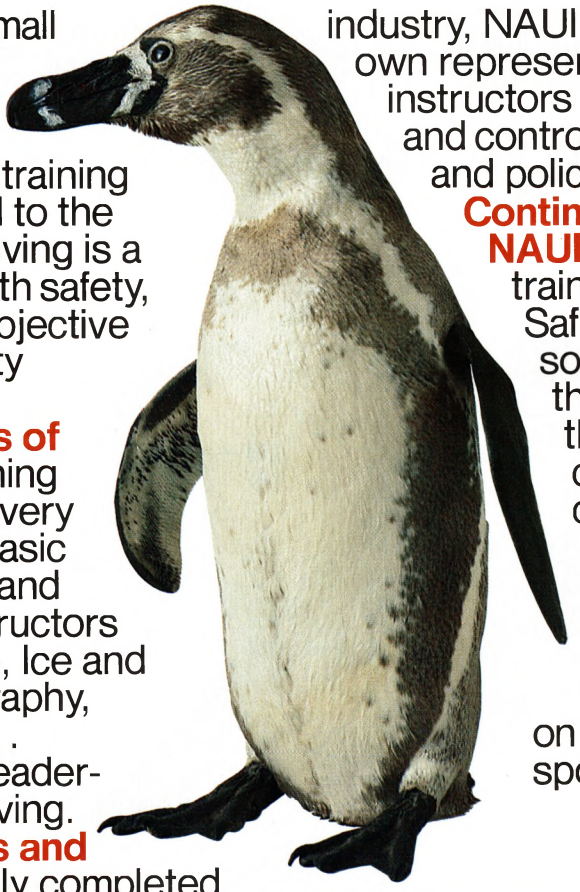
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RICK FREHSEE

SPORT DIVER

SUMMER 1979

DESTINATIONS



The Virgin Islands Destination Guide 55
by Ray M. Teboe
The flavor is American, but the diving is splendidly Caribbean. The U.S. and British Virgin Islands have shallow reefs, dropoffs, the Hydrolab and the world's most famous shipwreck—the *Rhone*. On land you'll find gracious accommodations, 300 years of history and fabulous duty-free shopping.

California's Channel Islands 99
by Carl Sisskind
Canyons and kelp forests make the Channel Islands the best the West Coast has to offer.

Cover: A sea cucumber displays rare colorations in this photo taken by Leni Riefenstahl in the Red Sea. More work by this amazing octogenarian begins on page 113.

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FEATURES

PRODUCT SURVEY
Smaller Contained Underwater Breathing Apparatus 82
The manufacturers have finally discovered we're not all six-foot-four in our booties. This new gear fits right and comes in colors.

PROFILE
Leni Riefenstahl 113
by David Abrahamson
Once linked with the German propaganda machine, 80-year-old Leni has taken her cameras into the sea. And she says she's just begun.

BASIC INSTRUCTION
Tune Up Your Gear 119
by Dave Inman
Just brushing off dust won't get your gear in shape. Here's how to do it right.

ADVANCED INSTRUCTION
Assess Your Mental Readiness .. 123
by Dr. Patrick Bray
Even if your body's ready to dive, your mind may not be. Here's how to tell if your psyche is right.

HISTORY
Making an Aqualung 126
by Ro Sheffe
The instructions were primitive and so was the gear —but Chris Allison did it and lived.

THE LIVING SEA
The Battle for Looe Key Reef ... 130
by Alexander Stone
Confusion and controversy have stalled a sanctuary bid to save this Florida reef.

SEA TECHNOLOGY
Offshore Reactors: The Power and the Poison 136
by Ro Sheffe
Floating nuclear power plants could light up a city of 600,000—or destroy 300 square miles of ocean.

PORTFOLIO
Richard Ellis 142
by Richard Ellis
The most famous works of this marine historian are still the whale paintings. This collection includes his latest work and some of the classics.

SPECIAL PHOTOGRAPHY SECTION

Film Test 89
by Steve Frink
Side-by-side comparison rates the underwater performance of seven slide films.

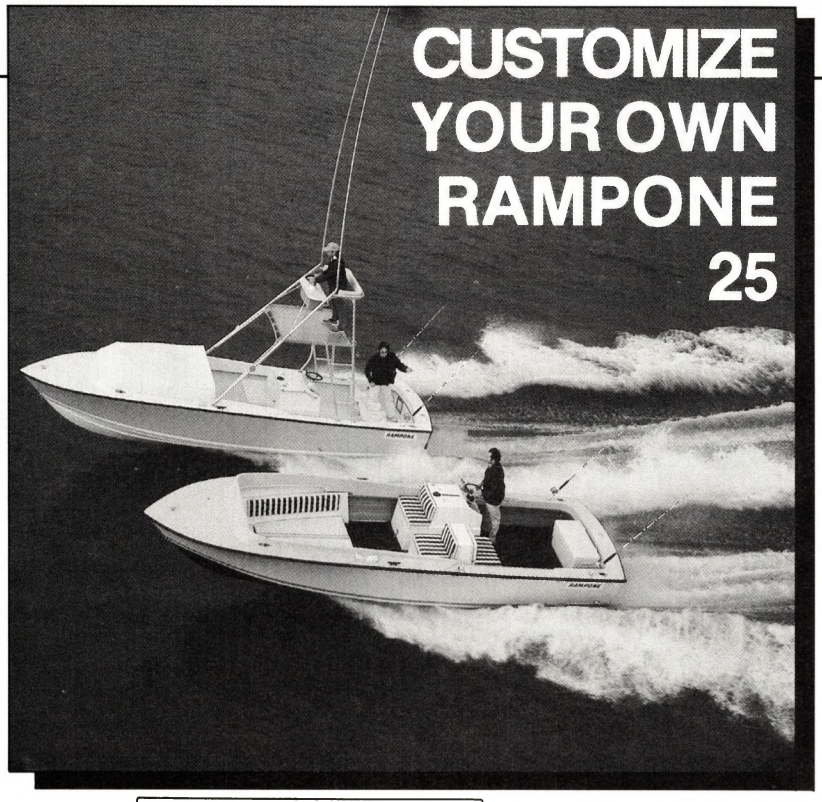
A Professional Approach 92
by Rick Frehsee
Twenty pro methods to sharpen your photos.

Process Your E-6 94
by Stephen Frink
Shoot today, view tonight. Processing your own Ektachrome means more control and less suspense.

DEPARTMENTS



Inside Sport Diver 8
New directions for underwater photography: Once more, with feeling.
The Mail 10
Lowell Weicker 14
Government intervention in diving may be inevitable unless we all clean up our act.
Richard Ellis 22
Sperm whales are the ultimate mystery of the deep. New evidence indicates they can dive to 10,000 feet.
Tim Cahill 28
California divers really are better, aren't they?
Letter from Bermuda 30
by Herb Chase
Letter from Washington 32
by Phil Trupp
New & Improved 47
A guide to gear and gadgets.
For Your Information 147
News from all over.
Physiology 152
by Bruce Bassett, Ph.D.
Pregnancy isn't the only concern for female divers. Here's the latest research.
Diving Craft 156
by James Duncan, Don Hubbard
Dive boats you can buy, inflatable boats and the heavy-haulers to get them on site.
The Edible Sea 171
by Paul Hill
Seaweed is good for more than wrapping clams. Delicious recipes for candy and casseroles.
Physical Fitness 182
by Tom Mount
Tai-Chi breath control can safely extend your bottom time.
Instructor Notes 190
by Lou Fead
Basic courses try to teach too much.
Working Diver 194
by C. K. Stewart
Diving inside of nuclear reactors is not your average Sunday excursion—unless you're Robert Shourot.
Pro Dive Store Directory 202
Reviews 208
Calendar 212
I Learned About Diving From That 216
by Howard Hall



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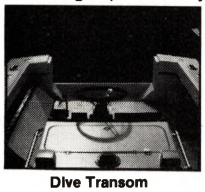
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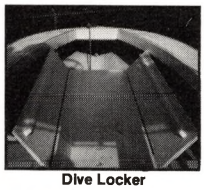
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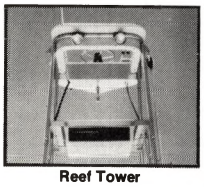
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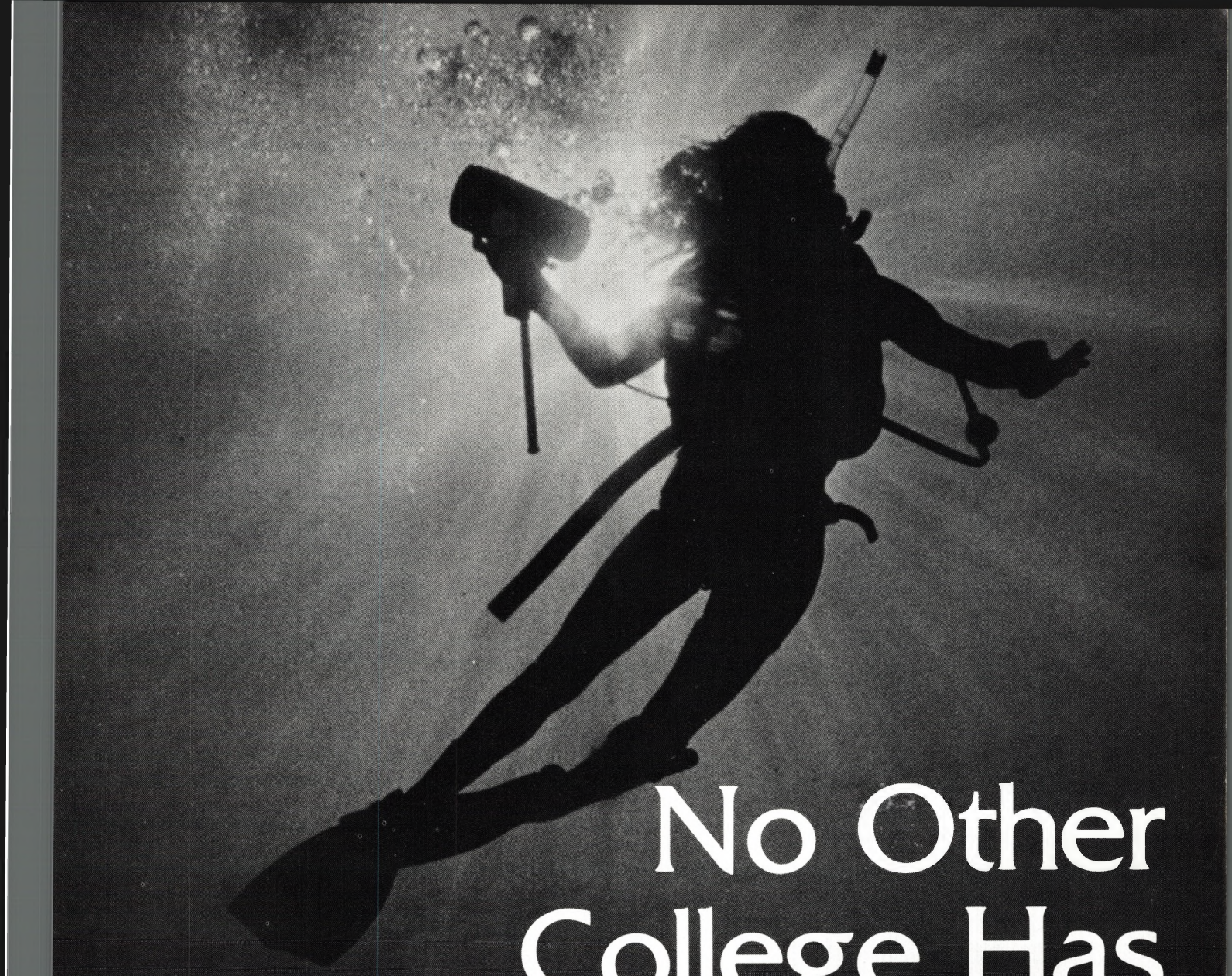
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Inside Sport Diver

Bridging the image gap.



STEPHEN FRINK

Incontestably film has become the most public, most personal medium of our time. Untold millions own cameras, and these cameras tag along wherever people go—to the beach, to the moon and naturally, underwater. Most likely it is the past, our desire to hold onto today until tomorrow, that fuels our photographic passions. It is important to know where we've been so that we have a continuing sense of who we are. The photograph provides that continuity.

Memory alone is unreliable. It colors events through selective recall and loss of detail. An event remembered as though it was yesterday is still almost completely obscured by today's sensations and impressions. Our ancestors answered this need with pictograms, drawings and paintings until technology gave us the 20/20 vision paintings lack. The camera firmly notes down the visual facts—size, shape, color, texture, lighting.

Most contemporary underwater photographs readily achieve this level of visual definition. The addition of an inexpensive plastic case to any point-and-push camera guarantees divers the memories they seek. For others, there is a more probing type of photography—one that admits that what the photographer felt is far more important than what he saw. It is the eye of the mind, not of the body, that sees most fully. Most people know the underwater world only through the photographs of divers. Divers may understand better the feeling of a photograph than their own feelings about what they have seen. If we are to appreciate the ocean, then underwater photographers must strive to bridge the gap between the viewer and that experience, the diver's joy of discovery—between note playing and music, between picture taking and image making.

For both picture-takers and image-makers, photography is a fascinating pursuit. And the technology to carry that pursuit underwater is readily available and easy to use. Yet like your body, most cameras were designed to operate best in air. And like your body, some instruction is helpful in obtaining the best performance underwater. To meet this need we have expanded our underwater photography instruction into a multi-part section. It contains basic coaching for the beginner, advice from top working pros for the more advanced practitioner and a techniques column that spans all levels of expertise and interest.

The new Underwater Photography section begins on page 89. Whether you're a picture-taker, an image-maker or merely an interested observer, we hope it will add to your appreciation of this exciting facet of sport diving.

Steve Blount

Steve Blount, Editor







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The Mail

Diving Doctors

The article by Dr. Bruce Bassett (Spring 1979) indicates a growing need for more diving physicians to serve not only sport divers but an expanding oceans industry.

This country has its economic problems at the moment, but the time is coming when we will turn increasingly to the sea for natural resources. That means more men and women will be cast in the role of explorers and researchers, and I can see the day coming when whole communities will live and work on the floor of the oceans. To effectively carry out this ambitious and much needed work, we will need creative physicians who can anticipate physiological problems in advance, and who will strive to build a new body of medical knowledge geared to the practical needs of this effort.

Edward J. Mann
New York, NY

...oops

Ken Hafner's article on the *S.S. Kamloops* in the (Vol. 2, Fourth Quarter) issue raised several questions. The photograph on page 113 is described as a radar photograph of the *Kamloops*. Is radar used under water? Also, which part of the CRT display is the *Kamloops* and which part is bottom?

I have used sonar in a very limited way and am merely trying to understand the photograph.

W.R. Folliott
Winnipeg, Manitoba

Radar, an acronym for "radio detection and ranging," is not used underwater. The large yellow mass seen on the right of the CRT display is Isle Royale as "seen" by radar equipment aboard the Superior Diver. *The central crosshatch is the position of the* Superior Diver, *with each concentric circle representing 1/4 mile distance from the boat. The* Kamloops *does not appear in the photograph, but is located NE of the crosshatch, between Kamloops Island (the yellow spot within the innermost circle) and Twelve O'Clock Point, the peninsula bisected by the second circle. The small photograph on page 114 definitely identified the wreck, a distinction perhaps made unclear by the caption. "Note the letters 'O-O-P-S'" urges the caption. We have. Sorry for the confusion—Ed.*

Okinawa Lives

I read with dismay Jeanette Davias' letter in the (Vol. 2, Fourth Quarter) issue. Her impression of Okinawan diving conditions convinces me that she has an extraordinary talent for finding the worst possible dive sites. Okinawa is still a good place to dive, and has some of the most interesting and varied underwater habitats to be found anywhere.

The coral destruction she refers to has occurred on the East China Sea side of the island where a beautiful fringing reef once existed. However, the Crown of Thorns starfish was not the principal culprit in its demise. In 1972 the administration of the Ryukyu Islands reverted to Japan. The Japanese government, in order to stimulate a depressed economy, poured funds for construction projects into the island. The by-product of construction is coral—devastating silt. From quarries at the ocean's edge on the Motobu Peninsula, sand and gravel were trucked the length of the western side of the island to build Highway 58, to reclaim land from the sea, and to create the 1975 International Oceanic Exposition (the theme of which was ironically titled "The Sea We Would Like to See"). The runoff silt from these and other projects destroyed the reef. On the Pacific Ocean side of the island are a series of small barrier and fringing reefs. Here the Crown of Thorns population is much more abundant than on the other side, but the reefs continue to be healthy. The difference is that, up to now, the Pacific side has been spared the intense construction activity. It was not a handful of shell collecting enthusiasts that created an underwater wasteland on one part of the island, but the encroachment of "progress."

Finally, diving instructors on Okinawa do not teach shell collecting. It is mentioned with other underwater activities as an interesting hobby. The decision to pursue any interest is an individual's. However, we do emphasize the importance of good conservation practices in all aspects of diving.

Gary Hagland
Okinawa,
Japan

Hard News Diving

Philip Trupp's "Letter From Washington" really opened my eyes to the Washington scene. I've enjoyed his past articles called Washington Currents, but I'm happy to see he's really getting into the nitty gritty, naming names, telling stories that ought to be told.

Divers must realize how important Washington is, how much it shapes our lives. These days many people want to get government out of our respective lives, but government has a real role to play in certain areas. And the most important area is ocean research.

I agree that the government must come up with an imaginative, far sighted effort to cultivate the world's seas and oceans. NOAA's lead-footed actions hurt all of us. We need the oceans. As Cousteau says, the oceans are the future of man. For NOAA to merely shuffle papers in the face of this is like Nero fiddling while Rome burned.

Stewart Ottenberg
Baltimore, MD

Octopi: Friend or Food?

Jacques Cousteau describes the octopus as "shy, playful and highly intelligent—and, if anything, a friend to man."

In the (Vol. 2, Fourth Quarter) issue Julio Traviesco concludes his article, *Octopus,* by saying, "Hopefully, with our added understanding of the octopus, man will come to regard this creature in its true light: the most intelligent invertebrate in the marine kingdom."

In the same issue, Paul Hill's article, *An Octopus Occasion,* tells how to serve an octopus dinner by candlelight that "...can lay a path straight to the boudoir."

To prepare this dinner, Hill says you simply "bite (the octopus) with your teeth hard, right between the eyes," or "beat it against a rock many times," or better yet, "freeze the octopus, live, uncleaned, unwashed, in a plastic bag."

Sorry, Paul.

In my home, an octopus dinner would lay you a path straight to, and out, the front door.

Janis Prater
Atlanta, GA

continued

We've gone to great lengths so you can go to great depths.

Chronosport is rapidly becoming the leading brand of divers' watches in the U.S.A. because of quality, styling, service and popular pricing. Chronosport was the first to introduce quartz diving watches both for men and women.



#3202 Atlantis Quartz

The newest addition to the quartz range and the most stylish steel divers' watch available. All of the features a diver needs like one-way bezel, mineral crystal, screw-down crown, high visibility dial and minute a year accuracy in a case pressure tested to 20 Atms. The low profile, slim styling and rich blue dial make the Atlantis a winner on land as well as in the water.

5 YEAR LIMITED GUARANTEE

#3202 Atlantis Quartz on strap $195 #3203 on matching steel bracelet $220

#3206 Sea Quartz 30 and #3806 Mini Quartz

The watch that professional divers select in preference to ones at more than double the price. For ruggedness and reliability the Sea Quartz 30 is unsurpassed. The Swiss quartz movement ensures accuracy of one minute a year. Scratch resistant mineral crystal, luminous one-way ratcheted bezel, high-visibility luminous dial with orange minute hand, stainless steel case with protective shoulder for the screw-down crown and pressure tested to 30 Atms.

5 YEAR LIMITED GUARANTEE

#3206 Sea Quartz 30 for men (on strap)	$180	#3806 Mini Quartz for women (on strap)	$195
#3207 on matching steel bracelet	$205	#3807 on matching steel bracelet	$220

Champagne Editions in 20 micron yellow gold-plate

#3407 Champagne Sea Quartz for men (on bracelet) $250
#3907 Champagne Mini Quartz for women (on bracelet) $250

Available from all leading dive shops or direct from Chronosport. Visa and Mastercharge orders welcomed.

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119 Rowayton Avenue
Rowayton, Conn. 06853
Telephone (203) 853-9593

Fitness Saves

Dr. Patrick Bray's article on diving fitness (Spring 1979) is very timely—and right on target.

I'm an assistant instructor and every ten weeks or so I'm faced with a new basic class. That class is generally made up of enthusiastic, intelligent people, all of whom are turned on to the undersea world of scuba. But there's a catch. While most of these people have everything going for them upstairs, they are usually in poor physical condition. We emphasize conditioning in our course, and Dr. Bray's exercises and suggestions will prove very useful.

I also think every diver, at every level of experience, should make it a priority to get in shape and stay there. That's the safest and best way to enjoy our great sport. It's fine to know the technical details of diving, but it's just as important to know and understand that wonderful machine, the human body, and to appreciate that safe scuba means a well tuned, ready-to-go diver. It's every bit as important as a well maintained regulator.

Bill Lund
Altoona, PA

Oasis Diving in the East

I'm employed by a U.S. based construction company now working in Iran, and came here from Virginia. Besides myself, there are two other sport divers on the job here and we are trying to have some gear sent to us for recreation. We're located on the Gulf of Oman and it looks like there should be some pretty good diving. Any information on marine life or related aspects would be appreciated. There are no "local dive shops" within about a thousand miles.

We have made several trips to an oasis about 45 miles from here. The oasis seems to be spring fed and, as far as we can tell, about 35 feet deep with visibility around four feet. We have planned a dive in it already, hoping that it's loaded with all sorts of goodies from gold to artifacts...who knows? We would bet our BCs that no crazies have ever done this before.

If you have any maps of the area or any good contacts with diving operators (if there are any) could you pass them on to us? There's virtually no sport diving activity here so our sources for information are pretty limited.

Bob Truston
Chahbahar, Iran

You already know more about it than we do —Ed.

Lampooning Scuba

Thank you for giving Dick Anderson space in your magazine. It's about time we had a little humor in diving, and Dick Anderson is making a good start. After all, diving isn't all squinty eyes and deeply knitted brows. It's human, it's fun, and Dick Anderson's article is the first good diving-related laugh I've had since finishing my basic scuba course. It's refreshing to know that your magazine appreciates the real value of that laugh, because without it diving would be reserved only for fish—not people.

Joan Herbert
Miami, FL

Hearing Both Sides

I would like to comment on a letter by Clifton McClure in the Vol. 2, First Quarter issue. In his letter, Mr. McClure stated, "The article, *Can Diving Hurt Your Hearing?* by Mr. O'Keefe, is definitely out of place in any progressive diving magazine."

I totally disagree with Mr. McClure. The objective of a progressive publication is to show both sides of the story. The fact that diving, even though the chance is slight, could be bad for your ears, is a point that should be made.

I feel that *Sport Diver* was correct in printing this article and should continue to print articles on controversial subjects. I do not wish to frighten new divers, but I do believe in telling the entire story and the total truth.

Paul G. Harris
Wolfeboro, N.H.

Wreck Researchers, Unite!

I am doing wreck research and I am interested in exploring wrecks and spearfishing in Florida, especially in the Keys. I am also completing research on the use and practical advantages of two hose regulators. I would be grateful for communication with any divers who have similar interests. Some details about experience, objectives, age, etc. would be helpful.

David Dodge
863 East Gulf Drive
Sanibel Island, FL 33957

Scholarship Information

I really enjoyed Ron Coley's article on the Our World Underwater Scholarship (Vol. 2, Fourth Quarter). However, nowhere in the article did he explain how to go about applying for the scholarship. Could you print this information in your next issue?

Terry Sharp
Temple, TX

Write Our World Underwater, P.O. Box 643, Wheaton, IL 60187—Ed.

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V.I. Divers, Ltd., PanAm Pavilion, Christiansted 00820. Tel.: (809) 773-6045

St. John: (Zip Code 00830)

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Frenchman's Reef Undersea Centre, Charlotte Amalie, Tel.: (809) 774-8500

St. Thomas Diving Club, Box 4976, Tel.: (809) 774-1376

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United States Virgin Islands



Photo: Bret Gilliam, V.I. Divers, Ltd.

Lowell Weicker

Government regulations threaten our access to the sea.

In the last issue of *Sport Diver,* I discussed the importance of supporting manned undersea exploration.

Many roadblocks stand in the way of advancing manned undersea exploration: high costs and low budgets, lack of trained personnel, and above all a lack of understanding of the immense value of man's presence in the sea.

Recent passage of federal standards for commercial divers that encompasses scientific and educational diving institutions is another example of unreasonable restrictions that threaten the success of man's advancement into the sea.

During the previous Administration, the Occupational Safety and Health Administration (OSHA) was petitioned by the Carpenters and Joiners Union (AFL-CIO) to develop standards for commercial divers, particularly those working on offshore oil platforms.

The Union was concerned about the consistency in safety techniques used by commercial diving companies. Whether these standards are necessary to achieve such a consistency is not at issue here. Unfortunately, through a series of misguided events, both sport diving and scientific/educational diving were swept into OSHA's rule making net. This is my present concern.

Through great effort and expense by the sport diving industry and a concerned lawyer, Jay Wenzel, sport diving was finally excluded from the standards; scientists were not so fortunate. Lack of a coordinated effort by the scientific community resulted in failure to exclude scientific/educational diving and it has since become part of the OSHA standards for commercial diving. OSHA notes that "the record does not adequately support a conclusion that the work conditions and risk exposure of scientific divers differs measurably from those of commercial diving."

Senator Lowell Weicker (R.-Conn.) is a concerned diver who has spent time in the Hydro-Lab. He is also a member of the Marine Resources Committee of the U.S. Senate.

I could fill many pages arguing the pros and cons of this statement. I believe the more fundamental issue for me is freedom of scientific investigation in the sea, and the impact of government regulations on its success or failure.

Sport diving was demonstrated to be a separate entity from commercial diving and was, therefore, excluded from the standards. It was argued that government control of sport diving could lead to control over other sports—skiing, hiking and baseball.

Throughout history man has had the freedom to explore the oceans with few restrictions. It should remain that way.

Scientific diving, virtually in its infancy, is charged with obtaining knowledge about the oceans on a first-hand basis. It has policed itself in terms of safety and has a remarkable record of diving with few injuries and fatalities.

Obviously, there are dangers. As science makes more and extended excursions into the sea, dangers will escalate. The government has a role, and that role should be to increase research into new and safer techniques, including table development and physiological studies on the effects of diving. Providing the best possible information concerning diver safety is a constructive contribution to the scientific community; inflexible regulations, on the other hand, can be harmful to the historic freedom of scientific pursuit.

If Columbus, Byrd or Lindberg were regulated the way our underwater explorers are presently regulated, there would have been fewer great discoveries in the past. Indeed this nation would, figuratively speaking, still be in the woods if it were not for the personal risks and pioneering spirit of our ancestors.

The possibility exists that some regulation will be necessary for certain conditions, but they should only apply where extreme hazards to life and property are clearly demonstrated. An accurate record on the issue of scientific diving has yet to be made.

As far as the OSHA regulations for scientific diving are concerned, there is a ray of hope.

Last year when the regulations were first published, my staff collected an impressive stack of letters from scientists all over the country, along with documented records of scientific dives numbering many thousands with an outstanding safety record.

Subsequent meetings between my office and OSHA, particularly with Basil Whiting, Deputy Assistant to the Assistant Secretary, produced encouraging results. Mr. Whiting was sensitive to the concerns of the scientific community and agreed to review alternative standards that are presently being developed by diver-scientists for the California version of OSHA. The Coast Guard recently published a version that excluded the scientists.

The federal government is an awesome force for the average citizen to deal with in a meaningful way, but we must remember that in this country the people are the government, and collectively the people can make things happen or change. In this case, a small group of unorganized scientists has raised its voice; they are right in their assessment, and I believe they will prevail.

People generally hate regulations or federal interference of any kind, but in many cases the government must act or regulate blatant man-made hazards to health, safety and the environment.

Several months ago, I made a dive off the coast of North Carolina to inspect ordnance in the form of torpedo warheads on the wreck of the German submarine U-352. The U-352 was sunk in 110 feet of water during World War II. As most readers know, the U-352 has become a popular wreck for thousands.

continued

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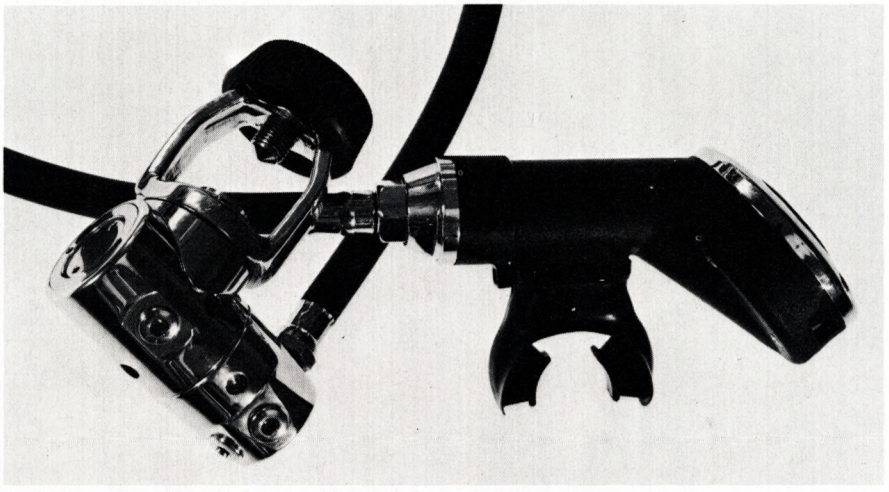
INTRODUCING Submarex®

A Division of General Diving

...a name you need to know

Sold only through specialized retailers, this full line of Swiss-designed diving equipment features clever design and top quality.

Not just another pretty face. Submarex diving equipment features clever design to do the job better. The Atmos I regulator is a perfect example of Submarex design skills.



Second stage low inhalation effort at any depth – unique shape.

ATMOS I REGULATOR– FIRST STAGE

• Balanced flow-thru piston, of course; Teflon-coated, it won't freeze up. Teflon high pressure seat; working pressure capability: 4500 psi. **Two** high pressure ports, **four** low pressure ports. Accommodates tank pressure gauge, second stage, auxiliary second stage (octopus), BC inflator and still has extra high and low pressure ports left over. This means the Atmos will never become obsolete, whatever new accessories the future may bring. **Clever design.**

• Unlike competitive units, the high and low pressure ports have different thread sizes. This is, for example, so you don't accidentally hook up a BC to 3000 psi. The Submarex tank pressure gauge has the larger fitting (7/16-20); an adapter is available so you can use current tank pressure gauges (3/8-24) with the Atmos. This different-size approach makes good safety sense, and is the direction of the future. **Clever design.**

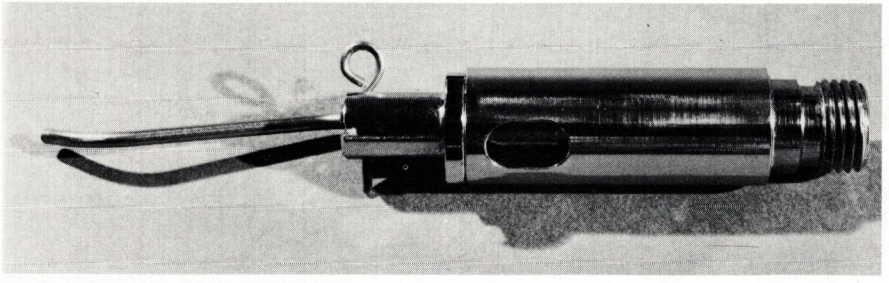
• Not only can the first stage pressure be adjusted (unique to piston first stages), but no caps or covers need be removed. If ever necessary, your dealer can adjust the low pressure in moments. **Clever design.**

• Instead of the usual flat sintered metal inlet filter, the Atmos uses a cone-shaped filter to triple the area and reduce possible inlet restriction. **Clever design.**

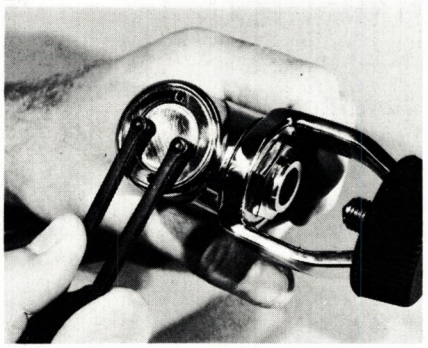
ATMOS I REGULATOR– SECOND STAGE

• Note the unique shape, with the exhaust port angled to one side. This allows a high leverage, long-diaphragm-travel mechanism, actuating an in-line large-bore venturi downstream valve. Result: Extremely low inhalation effort at any depth, at any effort level. **Clever design.**

• The glass-filled polycarbonate housing is symmetrical – there is no "upsidedown." This feature is especially useful when you add an additional "safe" second stage (octopus), as no matter how a



Modular design valve assembly.

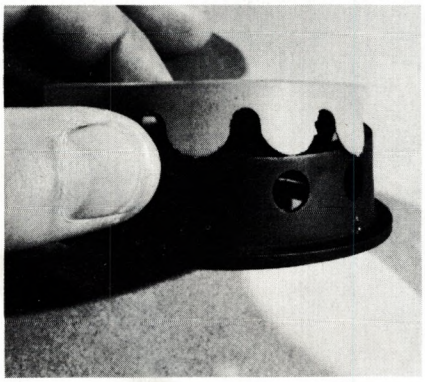


Easy external adjustment of first stage.

diver in need places the regulator in his mouth, the positioning is correct. **Clever design.**

- Exhalation effort is also unusually low, due to the unique 12-port, large-area exhaust valve ring. To breathe it is to believe it. **Clever design.**
- Unscrew the hose and the complete valve assembly slides out. Your dealer, if necessary, can replace this module with an exchange unit while you wait, keeping repair costs low, and minimizing your time and travel. **Clever design.**
- You know how some second stages use a single-screw brass clamp ring? You have to "spring" it to remove, risking a fracture every time. On the Atmos, three screws secure the face. Delightfully simple – **clever design.**

With all the easy-repair features, how often does Submarex expect you to have problems? So rarely the Atmos comes with a limited **lifetime warranty** for the first owner. The Submarex warranty system is unique in the industry. Customer satisfaction is a total commitment by Submarex.



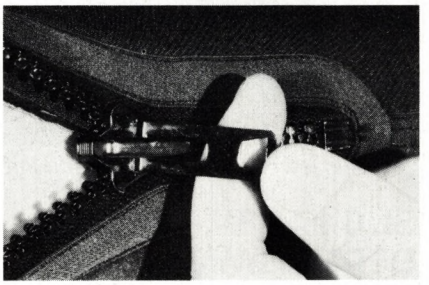
12-port, large-area exhaust valve ring.



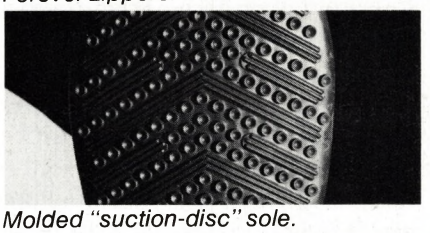
SUBMAREX DIVING SUITS

- The Submarex diving suit material is Fashion Flex,® a unique blown neoprene faced with double-knit Lycra on the outside, double-knit nylon plush on the inside (so soft it's almost immoral).
- In either the easy-in Farmer John version (with knee pads and clever built-in hood) or the high-fashion jump suit, there are five zippers for easy entry – the super-heavy-duty acetal copolymer "forever" zippers.
- Every seam is taped, glued and stitched.
- Edges are taped, with a double row of hem stitches; other seams have an incredible **four** lines of stitching.
- Boots, with a unique molded "suction-disc" sole, come in five sizes; note the "bent ankle" design for better fit while swimming.
- A separate hood is available for the stylish jump suit. (Would you believe the hood is stitched up from seven separate panels?)
- Most suits are in two- or three-tone colors, for a high fashion look.
- Sizes are S-M-L-XL, with length variations for any piece in short, regular, or tall for a perfect fit.
- The tail-flap fasteners are unique, and superior to twist locks or Velcro. Easier to fasten, just press to latch. Yet they are positive-lock devices; to open, grab the round button and lift (even with gloves). No accidental release, yet easy-close, easy-open.

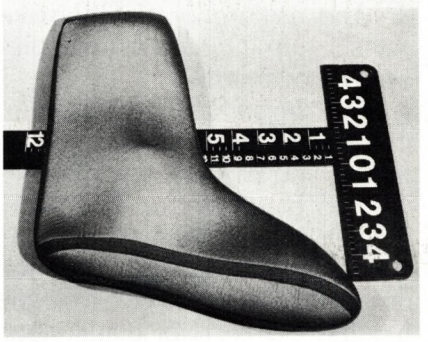
Again, **clever design.** Submarex is extremely proud of these suits and believes there are no better fitting, better made, or better looking suits on the market. See if you agree.



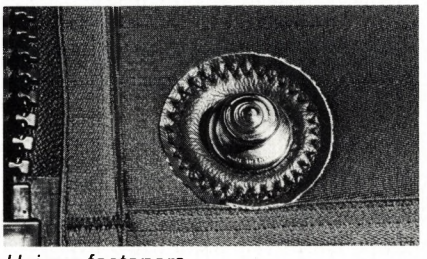
Forever zippers.



Molded "suction-disc" sole.



Bent ankle design.



Unique fasteners.



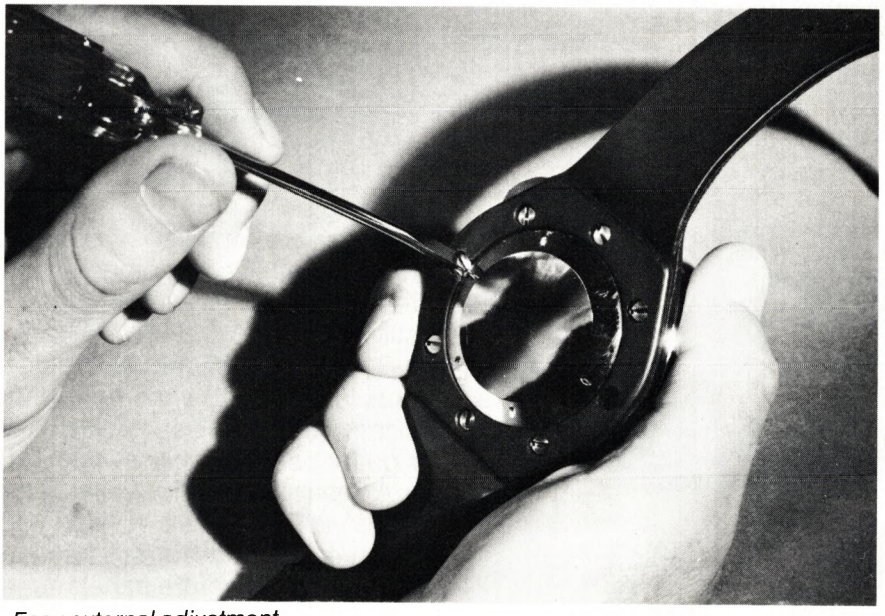
Diamond jewel finish – large clear numbers: 540° arc.

SUBMAREX PRECISA DEPTH GAUGE

See the full page color ad on this product elsewhere in this issue.

While most Submarex products are manufactured in the U.S., and the Precisa depth gauge will be assembled in the U.S., Submarex will manufacture the Precisa components in Switzerland. Where better to make parts for an intricate 4-jewel precision movement?

- The Precisa has no stop pin for the pointer to rest against. This means you know where true zero is – no hidden error. If a slight recalibration is needed (or if the diving is above sea level), the owner resets to zero with a simple external screwdriver adjustment. Note that the entire outer rim of the movement is a ring gear, which turns when the adjustment screw pinion gear is turned. **Clever design.**
- Note that the needle can swing through a full 1½ revolutions – 540,° exactly double the usual 270° arc. This extended travel allows the critical shallower depth ranges to be spread out, easily readable to one foot, while giving the instrument deep dive capability as well. **Clever design.**
- The strap is almost an inch wide and will encircle a maximum diameter of 4¼ inches. Comfortable and big enough for the largest wet-suited wrist.



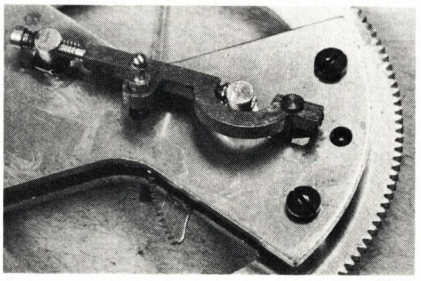
Easy external adjustment.

SUBMAREX DELUXE KNIFE

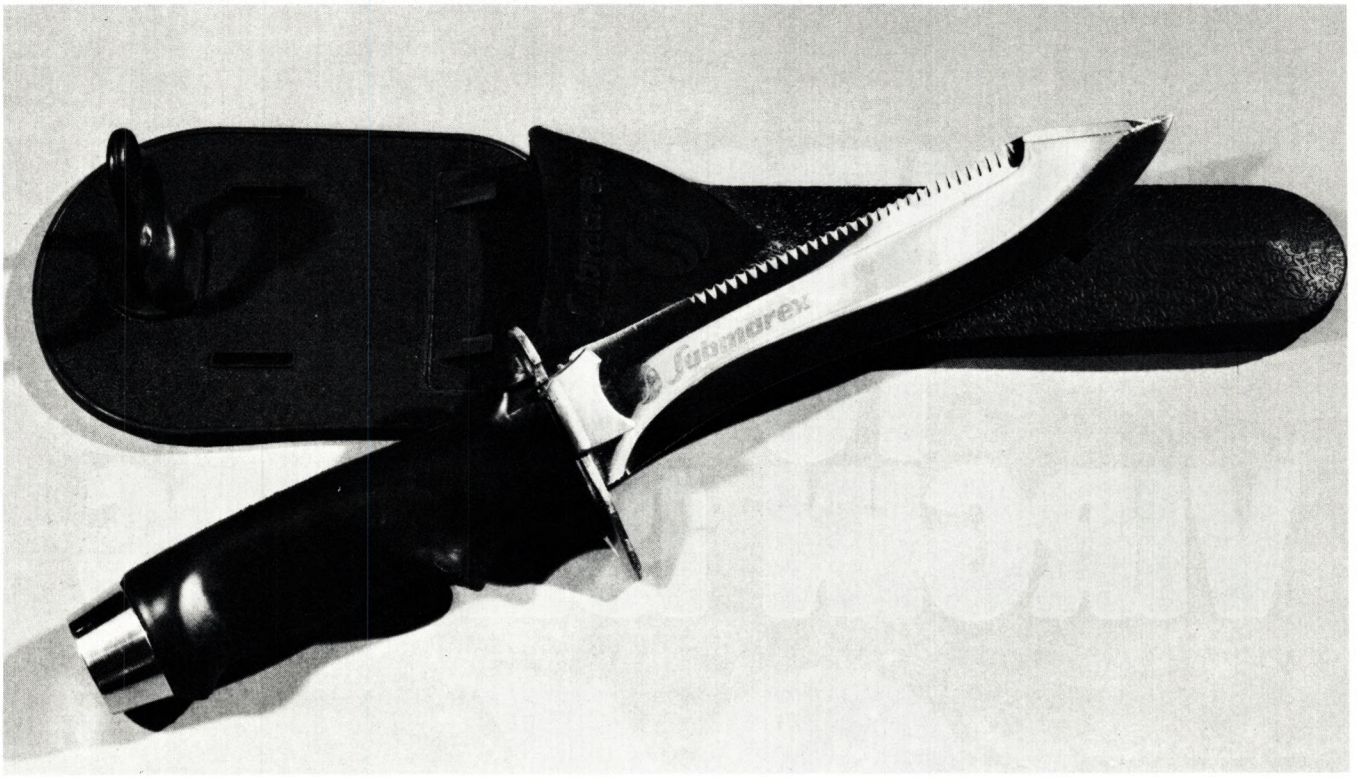
This large knife (12¼ inches overall, 7¼ inch blade, 13½ ounces) is another example of **clever design.** (And if the Swiss can't design a good knife, who can?)

- Hardened 400-series stainless steel blade
- Hard rubber sheath, with straps
- Super-effective serrated "saw" on top edge
- Etched length numbers on the blade
- Bottle opener, can opener, screwdriver (shades of "Swiss Army Knife"!)
- Hammer head butt also has lanyard hole
- Rubber handle sculpted for bare hand or gloves

These features are all there, although some are so cleverly integrated into the design as to be almost unnoticeable. And there's one more feature of the Submarex deluxe knife...it's beautiful.



4-jewel precision movement.



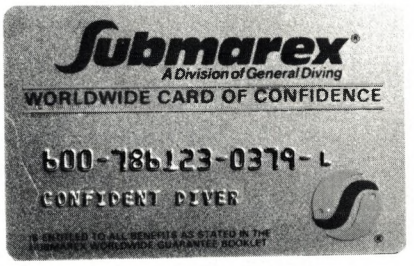
Hardened 400-series stainless steel blade.

OTHER SUBMAREX PRODUCTS:

Watches, instrument organizers, masks, fins, snorkels, weight belts, and tank pressure gauges – everything for the diver. All of a quality and design level commensurate with the items described here in detail.

Submarex is world wide, with manufacturing facilities in the United States, Great Britain and Switzerland. The parent corporation, General Diving, is closely-held and very strongly-financed. The U.S. company is headed by experienced divers who are also successful businessmen, with over 75 combined years of experience in the diving industry in designing, developing and marketing sport diving products. Submarex diving equipment meets the highest standards of quality and performance and, appropriately, is backed by the most comprehensive warranty in the industry. As a matter of policy, all sales will be through highly qualified, carefully selected professional speciality retailers.

Whether you are an active sport diver or a professional dive store owner, Submarex is a name you need to know. Submarex will play an important part in the future of the diving equipment industry.



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AIR FLORIDA

From the initial reports I received, the situation appeared dangerous—divers (many inexperienced) swimming around, playing with live warheads and other ordnance.

After the dive I formally requested the Navy to make an assessment of the situation.

After an on-site inspection, the Navy reported a torpedo lodged in the aft firing tube is armed and extremely hazardous. The Navy now has the task to render the U-352 harmless.

My concern here is for the safety of human lives. I would prefer to see the U-352 preserved as a safe attraction for divers and an artificial reef for marine life, but I made it clear to the Navy that disarming should not be attempted if there is a high risk to Navy divers, in which case, the ordnance may have to be detonated.

Several people have sent letters condemning my efforts and viewed the exercise as another government interference into private lives. The letter from Wayne Moose to *Sport Diver* (Spring, 1979) is an example of the general misunderstanding of my role in solving the U-352 problem.

The point is this; our government historically reacts to problems after they have become problems. A mining accident, derailed train or collapsed building in which human lives are lost would prompt the government to investigate and ultimately draw up regulations.

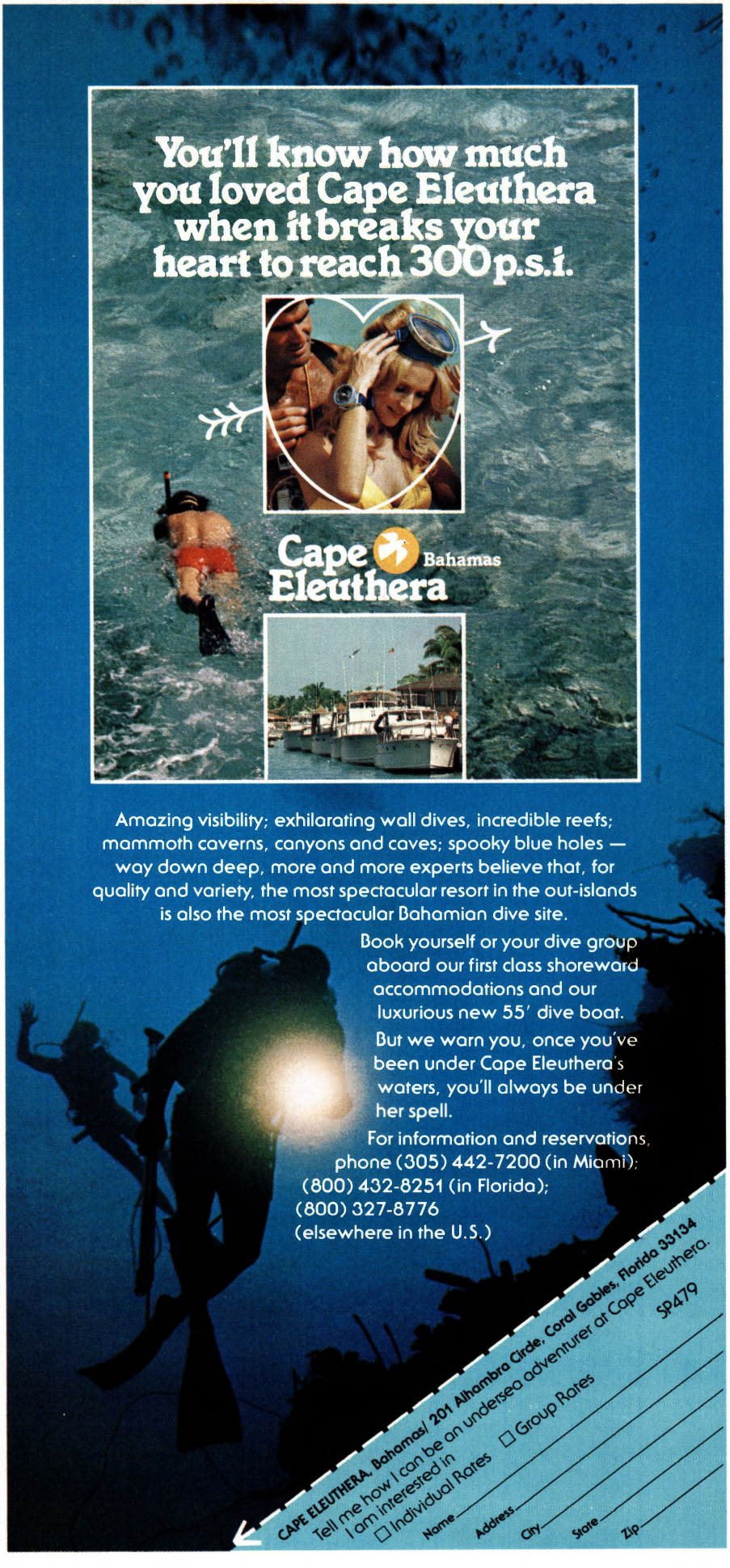
I have worked hard and long to keep the government out of diving, but a disaster on the U-352 which poses an obviously hazardous situation would nullify the efforts of myself and others to keep the oceans free of regulation.

If the ordnance in the U-352 is left alone and someone is later killed or hurt, government regulations of such wrecks could surely be expected.

In addition, having been made aware of a potential danger to fellow divers, I have an obligation to act.

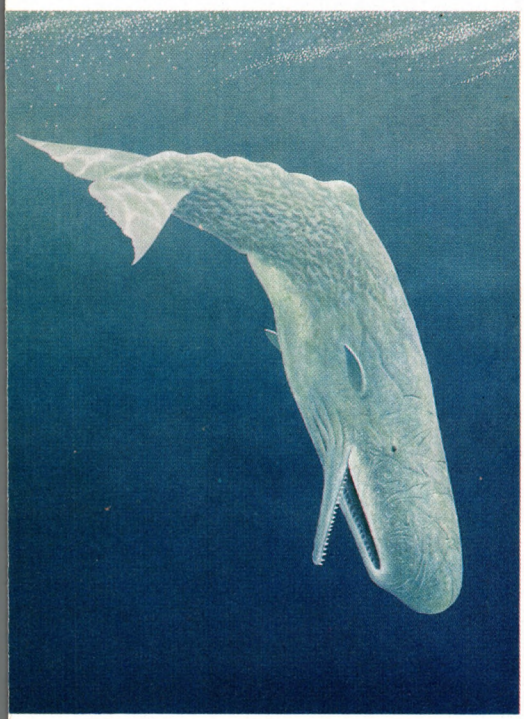
The sea holds a great future for this nation and the more we interact with it, the greater the chances for government control in one form or another. It is far easier to prevent regulations than to have them removed.

It would be more effective to work together towards this end than to fragment our efforts over individual problems. While we argue among ourselves over the pros and cons of disarming the U-352, the government regulators may be slipping through the back door.



Richard Ellis

Deep diving whales.



At 10,000 feet no light penetrates. The water is black as ink and the temperature can drop to 41° F. (4° C.). The weight of millions of tons of sea water produces a pressure of 4,450 psi, or more than 300 times the pressure at the surface. This environment, almost as alien to mammals as the planet Pluto, is the feeding ground of one of nature's most fascinating and mysterious creatures, the sperm whale, *Physeter macrocephalus*.

All whales, of course, are mammals and breathe air, and therefore must surface regularly. Their lungs function the same way ours do, but the myoglobin content of their muscle fibers enables them to store much more oxygen than we can. The precise mechanisms that enable these animals to descend to such depths are not known—in fact, much of the sperm whale's biology is poorly understood—but the evidence that they can perform these feats is almost incontrovertible.

When fouled undersea telegraph cables off the coasts of Europe and South America were hauled up for repair, the cause of the trouble was revealed to be a sperm whale that had become entangled in the cables and drowned. Examination of the carcass led to the conclusion that the whale had been feeding on the bottom, since its lower jaw was snagged in the cable.

In 1955, off the coast of Peru, a whale was pulled up from a depth of 3,720 feet—almost three-quarters of a mile. In 1969, an even more remarkable observation was recorded. A scientist was watching sperm whales from a spotter plane off Durban, South Africa. He noted that one of the whales surfaced approximately one hour and 20 minutes after he saw it dive, and it was immediately dispatched by the whalers. When this animal was examined, its stomach contained the fresh remains of small sharks. It was later confirmed that the species of shark in question *Scymnodon* are habitual bottom dwellers, and do not swim freely above the ocean's floor, supporting the hypothesis that the whale was feeding on the bottom. The ocean's depth where the whale was taken is 10,200 feet.

Old time whalers knew that sperm whales could remain submerged for prodigious lengths of time. Some observations have recorded times well over an hour, and there are reliable reports of whales that have remained below for 90 minutes. For comparison, the 1978 *Guiness Book of World Records* lists six and a half minutes as the maximum time a man has held his breath under water, and a bottlenose dolphin can stay under for about 17 minutes before it has to come up for air.

The sperm whale has to rest near the surface after a deep or lengthy dive, taking a series of short breaths until its oxygen debt is repaid. Whalers knew this, and would try to harpoon a whale while it was panting at the surface. They knew it could not dive deeply until it had taken approximately one breath for every minute it had remained below. The whaler's rule of thumb was not too far off the mark: A 50-foot whale would weigh 50 tons, dive for 50 minutes, and then take 50 breaths at the surface.

Using only its powerful tail flukes for propulsion, the whale dives to great depths to hunt squid, its primary food. Although the stomachs of sperm whales have been found to contain various fish, sharks and other creatures—not to mention sand, stones, rubber boots and other refuse that could only be ingested by a bottom-feeding animal—the staple of the sperm whale's diet is squid, usually deep water varieties.

We have all seen the illustrations of a sperm whale locked in combat with a giant squid, often looking as if the squid is trying to eat the whale. We don't know how the sperm whale hunts its ten-armed prey—we don't know much about the habits of the squid, either—but we can assume that each meal is not such a violent battle, for no animal could survive if every meal involved a life-and-death struggle for the predator as well as the prey. Sperm whales do eat giant squid, but most of the cephalopods consumed by the whales are much smaller, less than three feet in length. Indeed, if it were not for sperm whales, our knowledge of deep water squid would be even more sparse than it is today. Some species of squid are known only from the stomachs of captured sperm whales, and have never been caught in fishermen's nets, or found washed up on shore. The largest of the squids, the giant *Architeuthis*, reaches a length of 60 feet, and has never been seen alive. All known specimens have been found washed ashore or taken from the stomachs of sperm whales.

Squid are creatures of the depths, and whales must dive deep to get them. We don't know how they locate their prey, but they probably use some form of echolocation. Sperm whales make

continued

Richard Ellis is a writer and illustrator whose world is natural history. His illustrations have appeared, among other places, in ***Reader's Digest, Audubon, Sport Diver*** *and the new edition of the* ***Encyclopedia Britannica.*** *Ellis is also author of the* ***Book of Sharks.***

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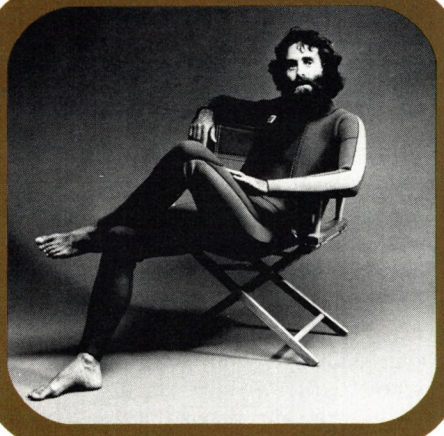
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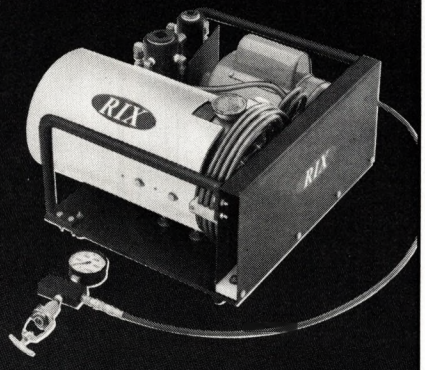








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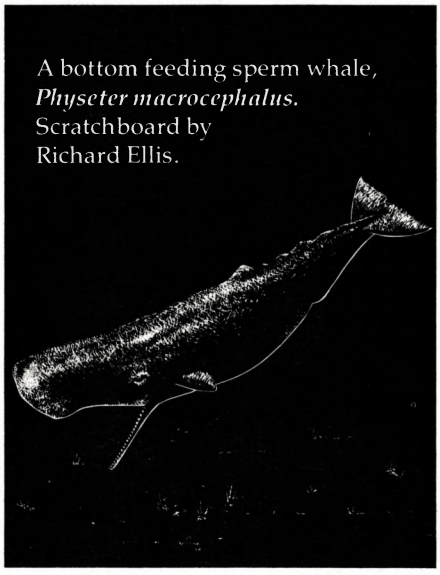


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A bottom feeding sperm whale, *Physeter macrocephalus.* Scratchboard by Richard Ellis.

various sounds including wheezes, clicks, moans, bangs and knocks, but scientists differ as to whether these sounds are used for echolocation. Smaller cetaceans, such as the bottlenose dolphin, send out a series of rapid clicks which bounce off obstacles and prey, giving the dolphin a precise reading on what is in the water with it. However, it is not scientifically valid to assume that if some cetaceans echolocate that they all do. The whales may echolocate the squid; they may stun them with focused sonic beams or may wait immobile at great depths and let the squid come to them.

However they accomplish it, sperm whales consume an enormous amount of squid. One scientist has estimated that their total annual consumption of squid is close to the total weight of mankind. A single sperm whale may have 4,000 squid beaks in its stomach, although there have been individuals with as many as 30,000. It is estimated that a full-grown whale has to eat three percent of its body weight every day, which in a 40-ton whale would be about 2,400 pounds of food.

The sperm whale differs from other whales—it is, in fact, unique in all the animal kingdom—in the existence of an extraordinary structure known as the spermaceti organ. The curious name of the whale is derived from early assumptions that the oil reservoir was the animal's seminal fluid. Cushioned in the massive, asymmetrical skull is one of nature's most unusual creations: A complex arrangement of tubes, sacs, valves and oils that may contribute to the animal's buoyancy control, sound production, pressure regulation or deep diving abilities. The organ probably serves more than one of these functions, and others we can only guess at.

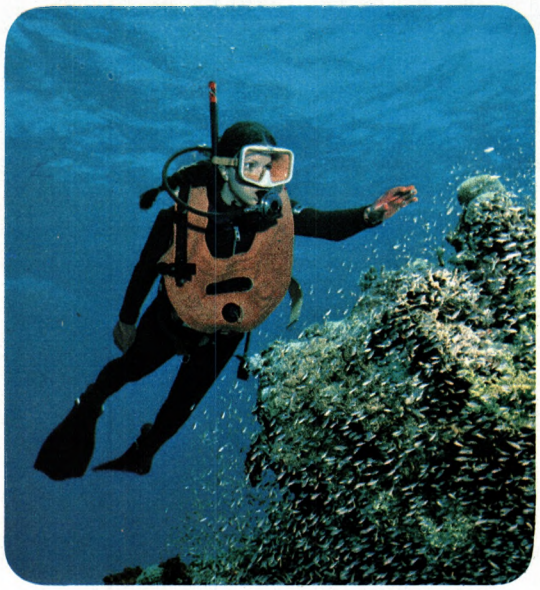
The oil contained in the tough membrane known as the case is that for which the New Bedford and Nantucket whalers spent years at sea, and often risked their lives. It is a clear or straw colored liquid wax which solidifies as it cools. This solidification occurs as it is exposed to the air, so whalers tried to ladle the oil directly out of the head before it hardened. As readers of *Moby Dick* will recall, the harpooner Tashtego fell into the case as he was bailing it, "...and with a horrible oily gurgling, went clear out of sight." He was rescued, but since the case of a full grown whale can supply as much as 500 gallons of oil, one can imagine the size of this organ and the danger involved.

In earlier times, this oil, known as spermaceti oil, or simply sperm oil, was used in the manufacture of smokeless candles. Today it is used as a lubricant for fine machinery, but not in the United States. Here, all whaling has stopped, and there is a ban on the importing of all whale products.

The sperm whale is the largest of the odontocetes, or toothed whales. The only larger whales are some of the baleen whales, which feed on small organisms by filtering them out of the water. Considering only those animals that eat large prey, the sperm whale is the largest predator that has ever lived. It has the largest brain of any animal known; that of a mature bull can weigh 20 pounds. It is also the deepest diver of any mammal, a creature whose everyday feeding activities make our most sophisticated diving equipment pale by comparison. Surely this amazing animal, whose capabilities are at once awesome and mysterious, should not be used in the manufacture of margarine, pet food or shoe polish. Of all the large whales, only the sperm whale is hunted in large numbers by the Russian and Japanese pelagic whaling fleets.

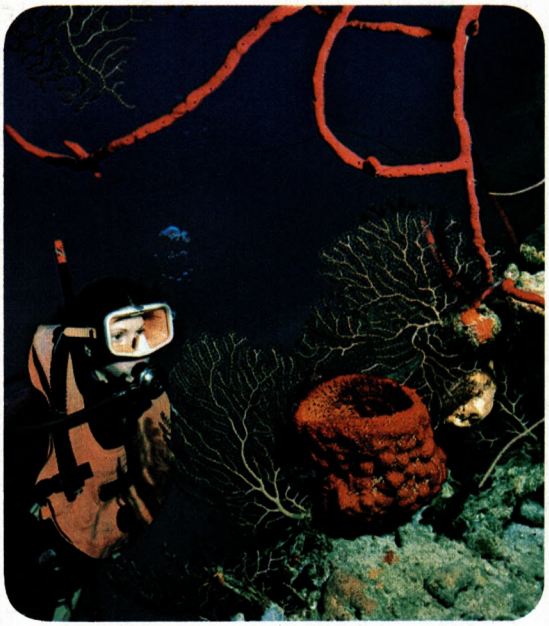
I believe that we should feel honored to share the oceans with such marvelous creatures; we may even learn some of the sperm whale's secrets. In *Moby Dick*, Herman Melville wrote, "...the sperm whale, scientific or poetic, lives not complete in any literature. Far above all other hunted whales, his is an unwritten life." Even for all our technological advances, much of his life still remains unwritten.

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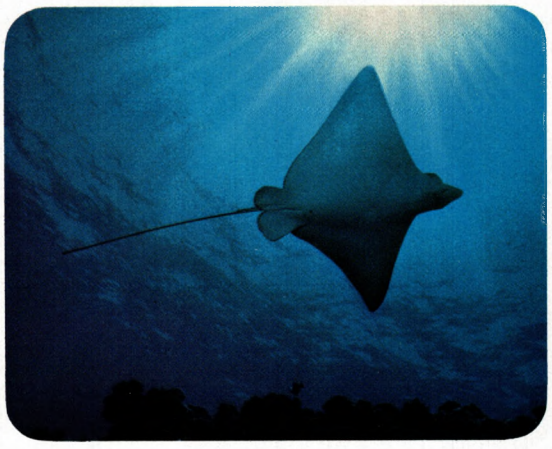












Photos by Carl Roessler

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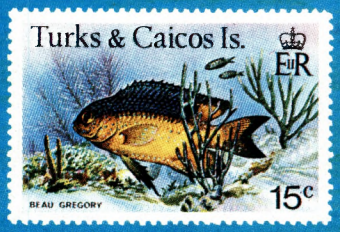
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Tim Cahill

On the natural superiority of California divers.

Swirling, bitterly cold sub-arctic currents feed into a huge mass of cold water which flows south along the Pacific Coast of America. This latter is called the California Current, and its waters are only slightly too warm for ice bergs.

It is this current which makes California divers strong of limb, stout of heart, clear of eye; and I suspect this is also true of our diving brothers and sisters in Washington and Oregon. We are, all of us, courageous, impervious to normal discomforts and the toughest sob's in the ocean. We are wooden ships and iron men; we are women of steel and men whose equipment clangs like brass when we walk. We dive the California Current and we are heroes.

Experienced divers know this. Take the editor of one national sport diving magazine for example. There he is, sitting in his air conditioned office in Miami. Outside, a fragrant ocean breeze gently stirs the stagnant, 85-degree air. It is 11 o'clock. In the morning. He dials the number of a California diver.

Now, when it is 11 in Miami, it's eight in California. Nobody in California gets up at eight. Everyone in California is from Arkansas or Oklahoma or Waukesha, Wisconsin, and we moved to California so we could sleep until noon each and every day.

The diver rises resentfully, picks up the phone, and there's the editor. He sounds disgustingly bright and bushy-tailed, saying "Hiya," and "boy howdy" with an accent that summons up images of some guy in a tattered shirt sipping moonshine from a crock jug and passing out with the hounds.

The diver, like all Californians, speaks precise and flawless English. The conversation sounds like some obscure Harold Pinter play featuring Gomer Pyle and Richard Burton.

What the editor wants is an article about diving a specific spot off the California coast for the summer issue. Now this particular spot is dark and cold. There's a particularly vicious surge and the currents are treacherous. It is that way even in the summer. The local dive stores advertise their trips to the spot like this: "Dive the frigid, impenetrable waters of spectacular Isla de Muertes (Island of the Dead)."

"Who's that?" calls the diver's current roommate. Like all California women, she is 18 years old, a blond with blue eyes, an all-over tan and insatiable appetites. Her name is Robin.

"Some guy who says he's President of the United States," the diver shouts.



ILLUSTRATION: JOHN LAKEY

"He wants to know if I can balance the budget for him this afternoon."

"Rully," Robin says, "Who is it?"

The diver covers the mouthpiece on the phone. "Some cretin from Miami," he says. "Wants me to dive Isla de Muertes for an article."

"The Island of the Dead? Tell him it's the middle of January."

Outside, another winter storm is passing through. Rain lashes the windows and ragged trees flail in the gale-forced winds. Mean air temperature is 35 degrees.

"It's the middle of damn January," the diver points out in his rich, resonant Richard Burton-like voice. "The cattle are frozen in the fields. I can see them out there with their hooves in the air, all glazed over with ice. You know who goes diving in weather like this? Future dead people, that's who.

"If this article is for the summer issue," the diver says, "why don't I do the dive in the summer?"

The editor explains what the diver already knows: the magazine's deadline and production schedule are such that an article completed in the summer could only be printed in the fall.

"Dive boats won't be operating this time of year," the diver lies. "I'll have to catch a rip and swim out four or five miles. That ought to be worth at least another $100."

The diver, who knows a bit about Caribbean waters, figures he has flattened the editor with a great wave of guilt. Florida divers don't swim. They go to the Bahamas, drink gin and tonic, then flop out of some boat like dead tuna. The sea is like bathwater, visibility is 100 feet plus, and everything around them pulsates with color. They drift in weightless splendor, feeling blessed. When the water temperature drops much below 80 degrees they complain of water chill and talk about hypothermia. At night, they wet their beds.

In California, divers haunt the kelp beds. Great oblique shafts of light glitter through these vertical plants; the effect is that of a redwood forest at dawn. We dive these ice water cathedrals and return to shore weary but triumphant. We earn our pleasure and we do not wet our beds.

"What do you mean, $25," the diver exclaims in his flawless manner. "You know what's out there? Dead guys! Yeah. There's about a dozen of them lying in a trench at 100 feet. A bunch of skeletons in moldy old wet suits."

"Okay," the diver mutters. "If that's the best you can do, sure. Yeah, by the middle of February. Goodbye."

"So," Robin says, "Are we going?"

"Not only are we going," the diver says delightedly, "We're also getting an extra $50 on the deal."

"Well perfect, boss and bitchin'," Robin says. Like all Californians—strong of limb, stout of heart, clear of eye—these two heroes never do anything they don't want to. They are California divers, stoic and hard as steel—right down to their frozen booties.

Tim Cahill is a former associate editor of ***Outside*** *Magazine and contributing editor of* ***Rolling Stone.***

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Letter From

...Bermuda.

BY HERB CHASE

The black sloop soared off a wave's crest and hung briefly airborne. Then she thundered down into a trough where the gale's force was strangely muted. My stomach was still up on that last crest. I was fatigued, half sick, and certain there had to be an easier way to dive Bermuda.

At the height of that gale, Bermuda seemed as remote as it had during the dark northern winter when we'd researched potential dive sites. In the tropic sun that we knew had to appear, Margie and I planned to cure our solar starvation and explore the reefs and wrecks of Bermuda's labyrinth.

It was sunny and the sky was Bermuda blue when we sailed into St. George's. The port is a model of British colonial architecture, still redolent with the atmosphere of empire.

Spanish sailors called Bermuda "Isle de Demonios", isle of devils. The lure of the labyrinth proved irresistible to a whole fleet of ships: There are some 70 submerged vessels which are dived regularly. These range from the remains of the French frigate *L'Herminie*, which went down in 1838 and around which are scattered enormous bronze cannon, to the *Crystal Catfish*, a racing yacht which crossed her final finish line in 1977.

Dropping backwards into the warm, clear water, we spiral down past the upper ridges of the reef towards the twin wrecks. The *Zovetta* sank here in 1924, the *Pelinaion* went down in 1940. Although sailing in different decades, both were bound for the same port—Baltimore—with the same cargo, manganese ore. They lie together on the same reef, less than 100 feet apart.

Bright yellow juvenile wrasse mingle with jacks, and on the wrecks, parrotfish exercise their incredible dentition on corals attached to the hulls.

Herb Chase is a freelance writer and travel buff who is currently sailing a dive/cruise yacht across the Atlantic.

This is typical Bermuda diving, 60 foot depths and 120 feet of visibility. A profusion of tropical marine life surrounds structural ship components that are remarkably intact.

Ashore there's more sightseeing than I have the stamina for, and sunning on the spectacular south shore





beaches. Evenings, there's a choice of discos and restaurants.

Curiosity about the origins of the islands and reef structures took us to the Bermuda Biological Station and Dr. Peter Garrit. He welcomed us warmly, and quickly sketched out the local geomorphology.

The islands are composed of a mass of consolidated carbonate limestone atop a shallow plateau of volcanic origin. Underlying the inshore waters and reefs as well, the plateau rises sheer from the depths of the Atlantic, almost three miles straight down. The warmth of the Gulf Stream and a permanent thermocline in the surrounding Sargasso Sea shield Bermuda from the temperature extremes of North America. Air and water temperatures range from 62° to 84° F. year round.

Corings collected by Garrit have revised some entrenched assumptions about Bermuda's reef development. It now appears the outward migration of Bermuda's reefs is much faster than was formerly believed possible. The new estimate of 30 feet per 5,000 years compares very favorably with reefs in more tropical areas, such as the Florida Keys and the Bahamas.

Feeling more knowledgeable, we prepared to dive the wreck of the *Avenger*, a British sailing vessel of two-masted rig. Captain Hicks put the dainty little brig up on Mills Breaker Reef way back in 1894.

We eased into the water backward, then lazily descended to a poignant evening in the late 19th Century. There at the bottom lies crystallized the moment of the *Avenger's* end. She splayed the coral heads in a ten-knot rush, tried to leap free of the reef, then sank with her bottom gutted in a sand hole beyond. We found lignum vitae deadeyes still strapped to her iron chainwales.

Coral unrolls beneath the dive boat's glass bottom as we head for our farewell dive, the remains of the *Cristobal Colon*, lying on the outer reef near North Rock. Legends of her sinking and the causes are rife, but local divers are convinced that Captain Delgado ran her onto the reef deliberately rather than proceed under orders to Veracruz. There he was to embark pro-government soldiers and return to Spain—this during the 1936 Spanish Civil War.

The *Cristobal* remained high and dry on the reef until she was blown up. She was a collector of ships; upright on the reef she gave the appearance of steaming in mid-channel.

The *Cristobal* now lives in a silent world. Man's hurried time has been replaced by the slower tempo of biological restructuring. Human order is replaced by natural order in a slow cycle of rebuilding. Too soon, our air is spent and we return topside.

Dive gear is cleaned and stowed aboard the *Endeavour*, tomorrow we sail east again, leaving the labyrinth, and Bermuda, for others.



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Letter From

...Washington.

BY PHIL TRUPP

When I receive a message from a politician urging me to return his call immediately, I generally place it in the circular file and take a leisurely stroll. I do this because the caller invariably wants a favor, and I can think of no reason why I should oblige. So when I was informed recently that a certain Senator A urgently wished to see me, I told my secretary to make no commitment until he telephoned a second time. As it turned out, the Senator persisted and a week later I found myself heading up to Capitol Hill where, I was told "one of the most important oceans stories of the year" (his words) awaited this magazine's exclusive pen.

When I arrived, the Senator's bright young aide offered a cup of coffee. I happily accepted, being slightly on the take. We then went into Senator A's office and he greeted me with the bluff good cheer of a comrade-in-arms.

"Sport divers have a lot of power these days," he said. "Maybe more than they realize."

I accepted his flattery as I had accepted his coffee—in such a way that the price of "importance" remained at only a few pennies.

Senator A became quite serious. With an almost clandestine air he took from his desk drawer a large volume and passed it across to me. It was a government report, several hundred pages long, titled, *U.S. Ocean Policy in the 1970's: Status and Issues.* A copy had reached my office a week earlier, having been sent by its author, Dr. James M. Curlin, Deputy Assistant Secretary of Commerce. Dr. Curlin had directed the study team at the request in 1976 of President Carter. Senator A, thinking he had an exclusive, masked his surprise when I told him I had read it.

Phil Trupp is ***Sport Diver's*** *Washington connection. An experienced author and diver, Phil has spent 20 years covering the Washington scene for major publications.*

As such reports go, it was an unusually articulate document tracing U.S. ocean policy since the 1920s through many commissions, policies and recommendations. If it was not particularly creative in its message, it certainly was encyclopedic. A decade ago, the so-called Stratton Commission had urged formation of a single agency to consolidate and manage the nation's oceans affairs. But, according to Dr. Curlin and his team of 100 contributors, the Carter Administration's push to decentralize and even dismantle governmental power is wholly out of keeping with such logical suggestions.

Those who stand to gain from a coordinated oceans effort are those directly involved with the sea.

Today there are more than 350 separate ocean-related statutes spread among more than 30 federal agencies. There is little, if any, coordination. Dr. Curlin's directive was to find a way to reorganize this diffusion of power into something more coherent. Instead of writing a series of program initiatives, he was left with the dreary business of bureaucracy, a task best suited to paper shufflers and multi-martini lunchers. Senator A was visibly disappointed.

"Understand," he said, "that even if we do straighten out this mess—and it'll take years!—it's only a beginning. It's like building a machine and later finding some use for it."

Senator A was perhaps a bit too dismayed. After all, he was an expert in the gloomy business of reports and studies; he knew well the workings of committee and compromise. His profession had taught him that anything is possible—until it goes to committee.

Of course the report was a cliché which told us again what we have known for years: that a lack of leadership has given us what amounts to no ocean policy at all. Obviously Dr. Curlin and his associates were as overwhelmed by the current state of chaos as Senator A and the rest of the oceans community. What Dr. Curlin apparently did not wish to say, however, was that in such messy circumstances there is no choice but to go back to the drawing board and start all over again.

"Damned shame," Senator A reflected. He said he felt sorry for Commerce Secretary Juanita M. Kreps, who would be called before Congress to answer questions about the report. "They'll tear her up," Senator A said, "and she doesn't deserve it."

It isn't easy to feel sympathy for a public official, but Mrs. Kreps is a rare exception. She is a graceful and charming woman, and she has a quick wit. As head of the ungainly Department of Commerce, an agency which has ruined many otherwise resourceful administrators, she has been astute. But the closest she has ever come to leadership in ocean affairs was last year when she was photographed by *People* magazine in a tee shirt which hailed the NOAA Corps, that shadowy agency's small fleet of research vessels.

Senator A also was careful not to criticize Dr. Curlin. It wouldn't have been appropriate in any case. Dr. Curlin is no lightweight. He is a respected scientist with a diverse background. Early in his career he worked at Union Carbide; later, he accepted a top position at the Oak Ridge National Laboratory. Over the years, he has been in contact with some of the most challenging thinkers in America, and his understanding of the oceans is reflected in the title he once held at the Library of Congress: Senior Specialist in Ocean Affairs. His basic philosophy of government is that an army of stags led by a lion is better than an army of lions led by a stag.

"Sure, Curlin's a good man," Senator A said. "No one's denying it. But I don't understand how he can take on a reorganization job and then, at the end of two years, tell us the answer isn't

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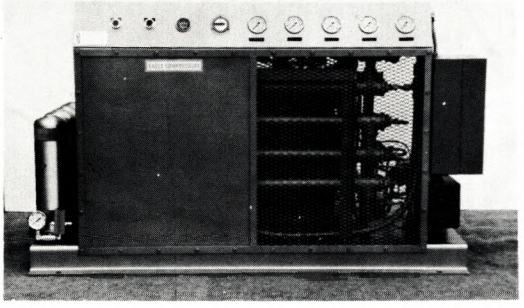
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reorganization at all. It's written on every page: we need aggressive leadership—not a new bureaucracy."

I had to confess there was a contradiction. But possibly Dr. Curlin had taken on the study against his keener instincts. Perhaps, with the selfless objectivity of a scientist, he did it out of a sense of duty. None of this seemed terribly important. What did seem important was that we were still leagues away from getting down to business. If nothing else, Dr. Curlin might have given us a suggestion for reprogramming the federal machinery, something simplified, and handed over the thing with the understanding that here, at last, was a mechanism with which to begin.

Senator A now pointed to a chapter titled, *Organizing the National Ocean Effort*. This was a crucial chapter, a summary of all that had gone before.

"They say here you can't build a program around anything as 'vague' as the oceans," he said. "They insist it's got to be economic. First you get a business going, then you relate it to the ocean. Well, I can tell you it won't work. It lacks guts."

That was true enough. Dr. Curlin had made it clear that ocean policy existed only in direct relationship to economic goals. For example, one talks first about deep sea mining and then about the ocean. Always the ocean is secondary, as if it were merely an irritating obstacle standing in the way of bigger, more realistic goals. I had to wonder how Dr. Curlin and his associates might have reacted when President Kennedy 16 years ago ordered the nation into a race for the moon. Viewed from this perspective it was easy to understand Senator A's annoyance with the timidity of the Curlin report.

"Someone will just have to stick our collective necks out and say, "That's it, America. We're going to explore the oceans and we're going to benefit from it. Period."

But why hadn't Congress taken such a position with which to confront the White House? The Senator grinned at my naivete.

"Justification. That's the name of the game. Folks up here want to know why they should be involved. Show them why and they'll demand more from the executive leadership."

He then accused the press of not doing its job. Why hadn't the major newspapers and magazines paid more attention to the Curlin report? Why

hadn't the leading columnists jumped on this newest failure to come to grips with ocean policy?

"You've got your magazine," Senator A declared. "You reach people. You talk to divers. Divers!—God knows they squawk loud enough when they think government is giving them a rubber saw. Why don't they do something positive? Act instead of react."

"We're like everyone else, Senator," I replied. "We've got to know why it's worth the time and trouble. Besides, divers aren't politicians, and very few look upon their skill as a useful political or scientific tool."

"Pity," he said. "You folks see the ocean in a way very few of us ever hope to see it. You're the vanguard. But where's your leadership?"

Senator A reminded me that just beyond his window hundreds of angry small farmers from all over the country were demonstrating for price supports. They too appeared to lack direction.

"Not many of us believe the farmers have any clout," Senator A said. "Fat cats around here know they'll make noises for a while. But not for long. We'll pat them on the head and they'll go away and won't bother us any more."

He did have a point. Like the farmers, divers only make noises when they're being pinched. Otherwise, they're part of the silent majority.

Those who stand to gain from a coordinated oceans effort are those of us directly involved with the sea. Even the purely recreational diver will profit from attempts to explore, tap and harvest the oceans. If nothing else, we will know infinitely more about our relationship to the sea and how it shapes our lives. Beyond this we will be more fully aware of our responsibility to care for the world's oceans, to keep them from being turned lifeless by careless industry or indifferent government. The oceans aren't simply a means of self-indulgence; they are critical to our existence, and every day of neglect diminishes us.

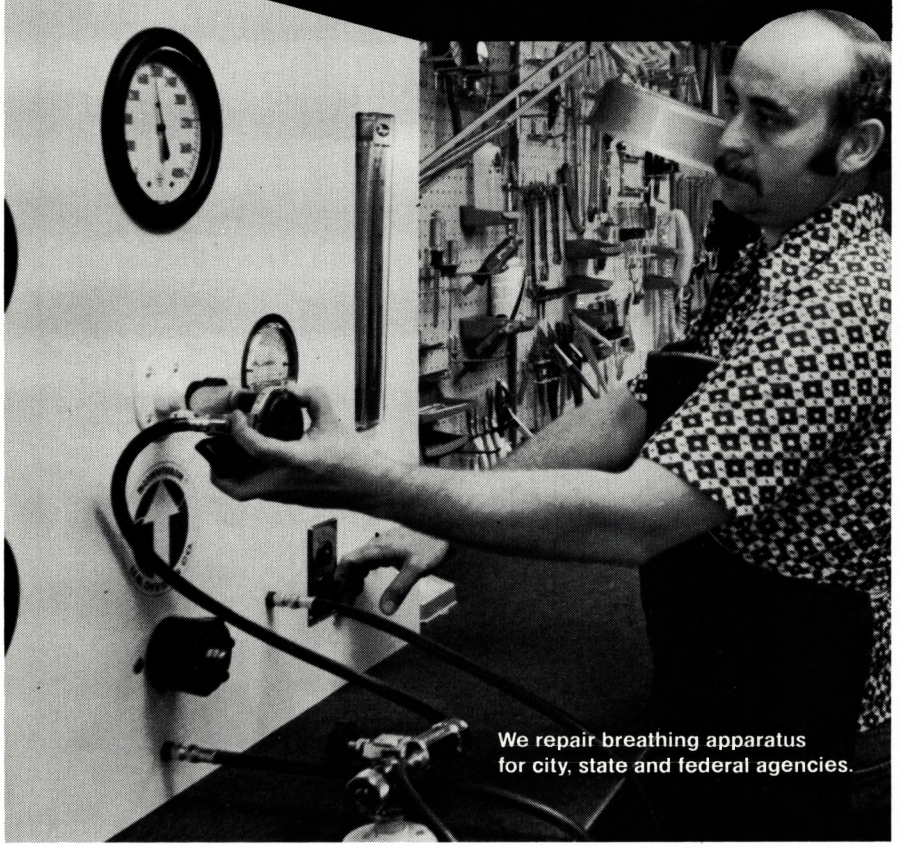
I thanked Senator A for his interest and stood up to leave.

"Tell your readers about this report," he said. "You tell them how far we've got to go."

How far? No one can say. Not even Dr. Curlin. After all, he hadn't been asked to write policy; he wasn't charged with firing creative energies. His task was to sort through years of confusion and ineptness and come up with a more reasoned approach. To a limited extent

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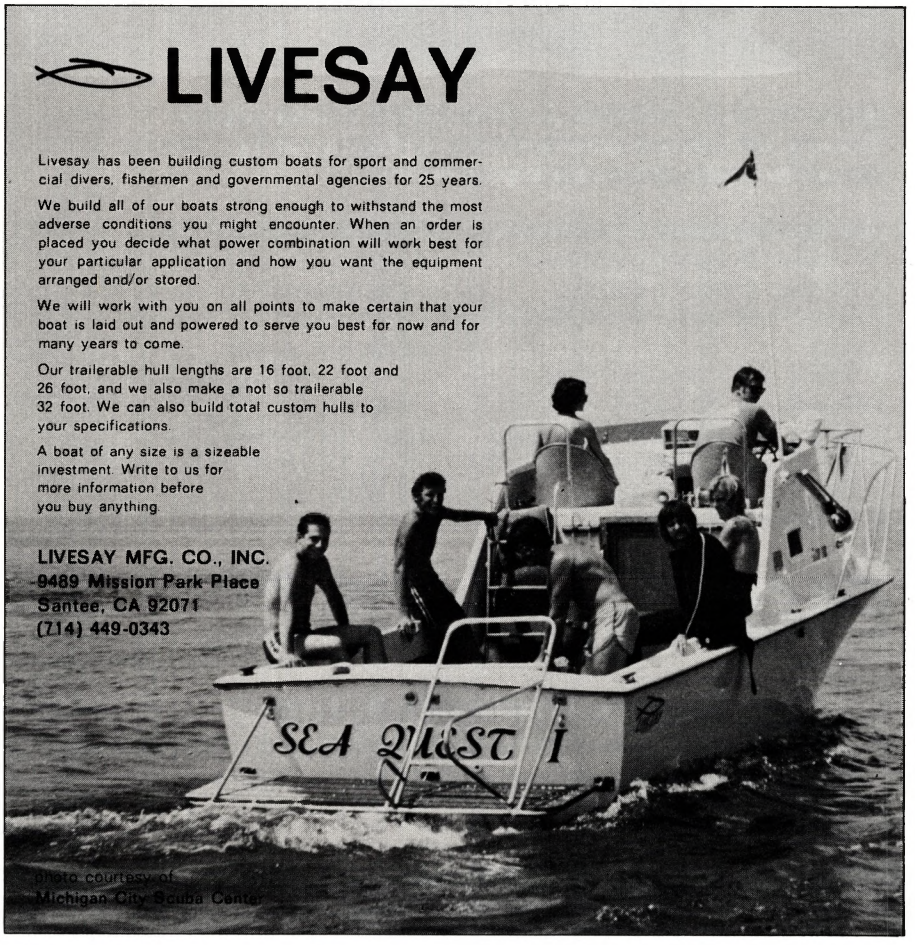


Photo courtesy of Michigan City Scuba Center

this was accomplished. But in the end one gets the eerie feeling that Dr. Curlin, like Senator A, must view the outcome with a kind of vague horror. It is the feeling one must have when returning to the scene of a crime.

President Carter's term of office is drawing to a close. Soon he'll be busy politiking for re-election. In 1976, he promised a bold oceans initiative. As divers, we suggest that Mr. Carter face up to his failure to do so.

Mr. Carter should have known that the sort of initiatives he promised three years ago would have purchased more than votes. If he had turned to the oceans, as he had promised, he would have gained his little corner of posterity, and we would have had the benefit of a new national adventure and a much-needed prosperity.

Washington Currents

New Treasure Law Surfaces

Controversy over federal control of historic shipwrecks and artifacts may heat up again with introduction of a proposal to give the Secretary of the Interior guardian powers over sunken treasure found on the outer continental shelf and in state territorial waters. The proposed legislation was introduced January 22 by Representative Charles E. Bennett (D.-Fla.). The bill (H.R. 1195) is now before the House Interior and Insular Affairs Committee. According to Tom Miller, an aide to Rep. Bennett, the idea is to circumvent the seemingly endless legal squabbles between state and federal governments and private treasure salvors such as Mel Fisher. Fisher fought a successful but costly battle against federal and state governments in claiming title to the famous 17th century Spanish treasure wreck *Senora d' Atocha.*

Essentially, H. R. 1195 proposes that wrecks and associated artifacts become the property of the federal government. The Secretary of the Interior would administer this property and make important decisions regarding salvage and disposition. Once federal jurisdiction was established all wrecks would automatically become federal property under federal management. For example, the Army Corps of Engineers would not be allowed to remove navigational hazards without prior consent of Interior.

Rep. Bennett's bill allows Interior to work with appropriate state agencies in the disposition of shipwrecks. The states and the federal government would draw up contractual arrangements for salvage, presumably with the state acting as an on-site overseer. Miller said the bill does not give Interior absolute power on the outer continental shelf, but rather makes it possible for individuals to gain salvage rights within more clearly defined legal guidelines.

Within the past year, suggestions from other federal officials to take control of drowned cultural resources have drawn the bitter opposition of organized treasure hunters. Their objections have been upheld by a federal district court in Florida which awarded title of the *Senora d' Atocha* to its finder, Mel Fisher, president of Treasure Salvors, Inc. When asked if Fisher or other organized salvors had contacted Rep. Bennett about H.R. 1195, congressional aide Miller said, "No. In fact, yours is the first call we've had on this one." A Washington source close to the Capitol Hill scene said the Bennett bill would have the effect of setting aside many state laws.

"Surprisingly," the source continued, "the treasure hunters seem to be behind this one all the way. They believe the bill will break up state programs which are too restrictive for their comfort."

Except as specified in the bill, the U.S. would not transfer title of any wreck to any person, it was explained. But absolute title isn't the issue. Instead, Interior would clear the way for the all-important agreement to salvage a wreck and dispose of artifacts.

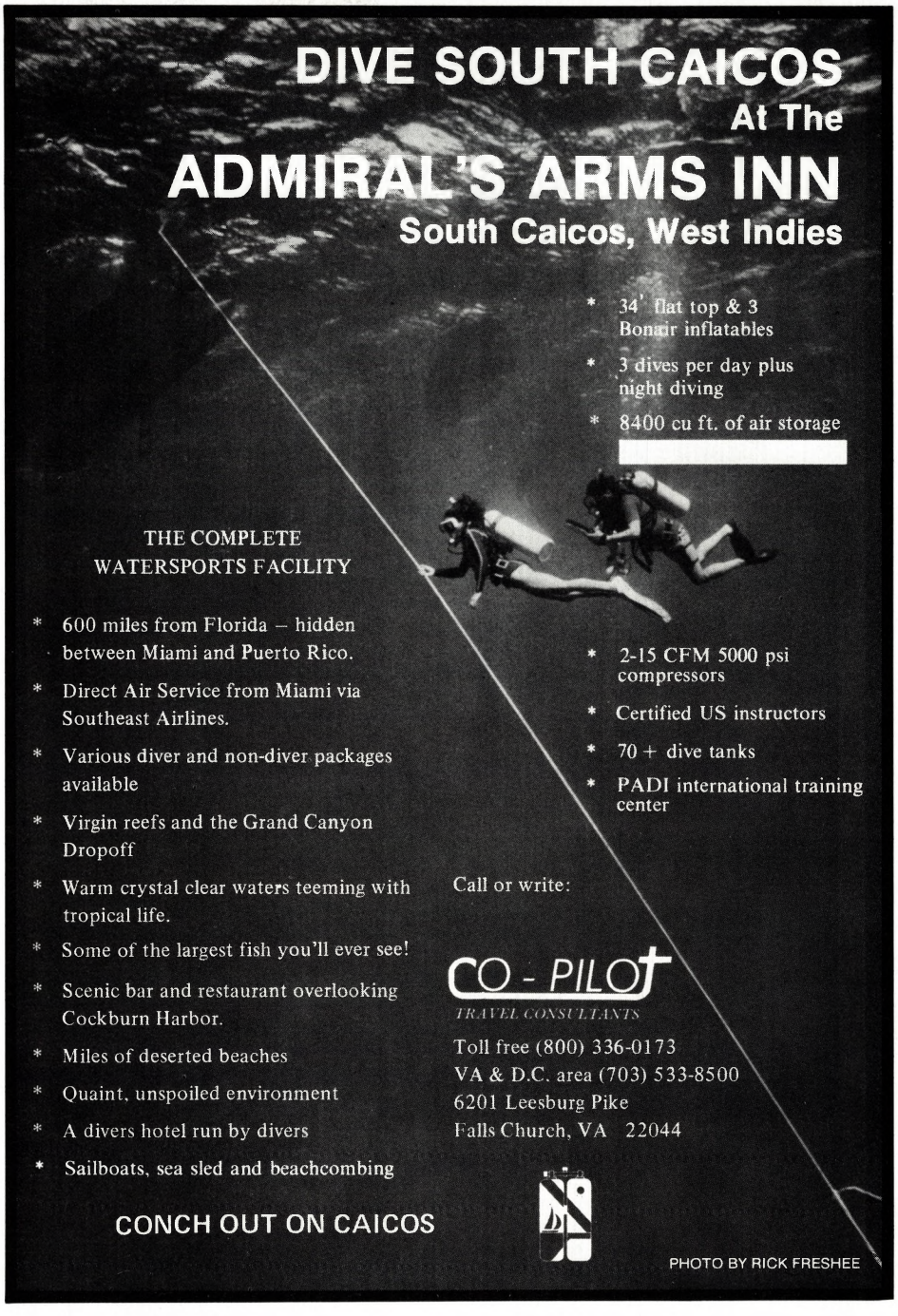
The source said a state may acquire any wreck within the three-mile limits of its territorial waters if it meets federal standards for disposition. All states are supposed to already have plans for protection of submerged cultural resources approved by the federal government, "but very few of them really do," the source said.

"This may be the legal loophole the treasure hunters want to slip through."

Several top Washington officials closely associated with treasure hunting laws told *Sport Diver* that H.R. 1195 "doesn't stand a chance."

"It strikes directly at states' rights," according to one Interior official, who also pointed out that no such law could be implemented until the U.S. completes its Law of the Sea Conference agreements.

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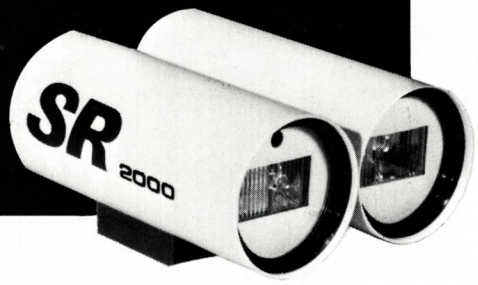


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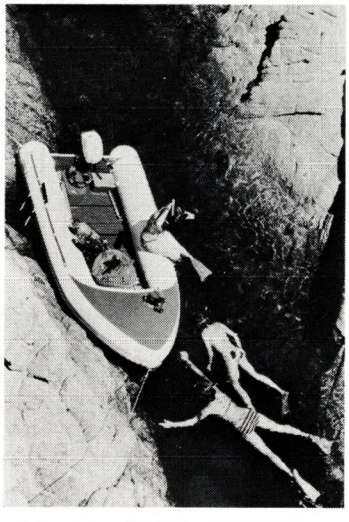


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Roatan Going Chic

Roatan, the remote and relatively undeveloped island paradise off the coast of Honduras, is scheduled for a major cosmopolitan face-lift—soaring hotels, condos, discos, international cuisine (frozen) and maybe a casino or two.

According to U.S. World Bank officials here, the tiny mountainous island, now a draw for American divers, has become part of a multi-million dollar plan to strengthen economic ties in Central America.

U.S. and Latin developers will team up on the project, scheduled to begin later this year or early 1980.

The development scheme is the brainchild of World Bank President Robert S. McNamara, who was Secretary of Defense under Presidents Kennedy and Johnson. One World Bank official said diving will be emphasized in the new plans.

"Some of the most beautiful reefs in the Caribbean encircle Roatan," he said. "But obviously there's plenty of room for tourist expansion into other areas and activities."

Ironically, World Bank planners apparently have neglected the disaster potential associated with Roatan. The island is subject to hurricane action, "but that hasn't been programmed into the planning," the Bank official said.

Is this a fatal flaw?

"It could be," acknowledged the Bank official. "But that's never stopped a shrewd banker."

Who'll Monitor the Monitor?

What's going to be done with the historic American shipwreck U.S.S. *Monitor?* At this point, no one's quite sure.

The Civil War ironclad, resting in 220 feet of water off Cape Hatteras, N.C., is one of two federal marine sanctuaries. Trouble is, it isn't much of a sanctuary. It's too deep for reasonable sport diving and erecting an above-water marker won't interest anyone except an occasional sea gull. Leaving this bit of history on the bottom seems a shame, but raising it will be enormously expensive.

Since the federal government doesn't have sufficient capital (or interest) to take the initiative, the state of North Carolina has drawn a rough plan of possibilities; among them, state man-

agement of archaeological research.

Critics of this approach say it's like throwing open the petrified forest to any qualified fossil hunter with an academic paper to write.

The Smithsonian Institution recently sponsored a conference of interested parties. But little in the way of solid planning came out of it.

When the time comes to raise the wreck or open it to full-scale investigation, there is bound to be plenty of controversy. This is probably for the best, since disposition of the *Monitor* may set precedent for later federal claims to marine treasures. When the issues break, don't forget to write to your congressman. Your silence will *not* be golden.

Sanctuary Amendments Rumored

The Marine Sanctuaries Act is a kind of rubber Jaws. The power to preserve and protect the marine environment is there, but the bite is flabby from disuse.

Since the act was passed in 1972, we have designated only two marine sanctuaries: Key Largo and the *Monitor* wreck. But today there are no less than 170 possibilities, or nominations, awaiting some federal action.

It's not likely to happen anytime soon, because with only $500,000 in the NOAA sanctuaries budget the agency says it hasn't got the money to do the basic biological studies, write environmental impact statements or hold meetings with citizens groups and state officials representing powerful commercial interests. Each of those 170 nominations represents money and time that must be spent in fair amounts, and the Sanctuaries Act says so.

Now come rumors of amendments to what is already a vehicle of compromise. Two years ago, Senator Ernest F. Hollings (D.-S.C.), a member of the Congressional Underwater Explorers Club, proposed congressional veto powers on any sanctuary covering 1000 square miles of water. This was apparently a means to protect very large tracts of sea bottom for commercial purposes. The second proposal by Sen. Hollings was to drop the so-called aesthetic criteria contained in the nominating guidelines. If, for example, one asked to save a reef because it is very lovely, Sen. Hollings would say, no, that's not enough. Sen. Hollings won in the Senate Commerce Committee, but was voted down in the House.

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But now there are rumblings within NOAA and on Capitol Hill that the amendments may surface again, perhaps in another form, and perhaps from someone other than Sen. Hollings.

Divers should know the fragile nature of the Marine Sanctuaries Act. It's one of the few federal laws which favor us directly.

Any action which exacerbates the compromising nature of the act must be intelligently questioned. Does a particular amendment give the law a keener bite? Or does it weaken it by inviting the intervention of groups which have no interest in conservation?

To work properly, the act needs more force, and that implies realistic funding. This will give us more positive powers of persuasion.

Better Late?—Never!

Let's hear it again for NOAA, which released in January a report on non-professional scuba accidents. That would be fine, except the figures are more than a year old.

Sport Diver reported the statistics in detail (Second Quarter 1978), showing an increase in scuba deaths nationwide from 131 in 1975 to 147 in 1976. The data were obtained from the University of Rhode Island's National Underwater Accident Data Center.

Since all of this is by now old news to our readers, the new news is the incredible bureaucratic lag in disclosing the figures to the public.

The University of Rhode Island submitted its report in September 1977. The data went to NOAA and the U.S. Coast Guard. As usual, the Coast Guard went rather quickly through its review process. But at NOAA, things bogged down, as usual.

What all this means is that when the 1977 accident figures are ready, NOAA won't get them to you until 1980—if you're lucky. This is a very distressing reality for scuba instructors and insurance companies, to say nothing of the frustration it must cause at the University of Rhode Island.

The University began its accident reporting in 1970 without NOAA sponsorship.

For a copy of the report, write to NOAA, 6010 Executive Blvd., Office of Public Information, Rockville, Md., 20852, and ask for *U.S. Underwater Diving Fatality Statistics, 1976*. It's free.

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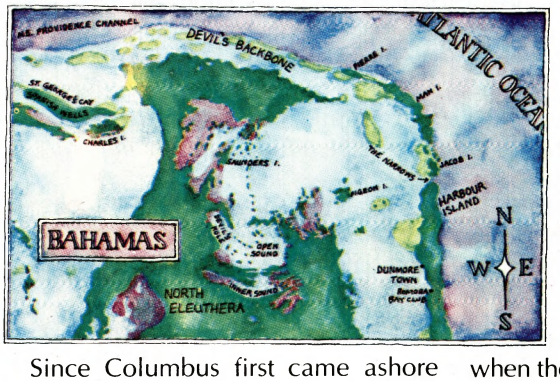
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Devil's Backbone Reef hides the world's strangest shipwreck... and a case of Canadian Club.



Since Columbus first came ashore here, sailing men have been littering the Bahamas' blue waters with shipwrecks. Some carried treasure, some crowned heads. But the strangest of all carried a train.

Hell for ships, heaven for divers.

The train lies off Eleuthera's northern tip, scattered on Devil's Backbone Reef. At least six wrecks are strewn here: a diver's paradise, we thought, and a perfect place to hide a case of C.C.

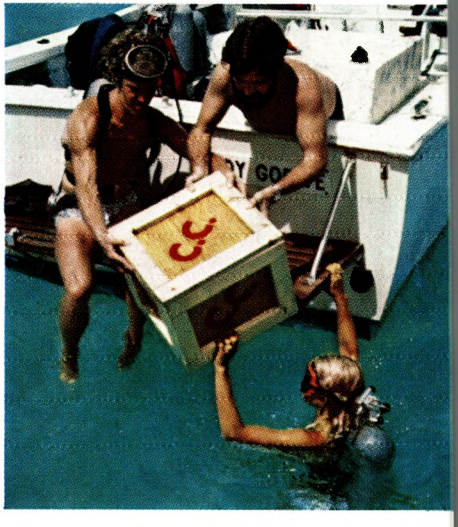
We headed for Romora Bay Club on Harbour Island. The club could provide us a launch and guides to explore the reef. Nearby Dunmore Town could offer Bahamian entertainment, complete with Canadian Club. But no one could provide us with a reliable story of how or when the train had sunk on the reef.

A barracuda stands watch.

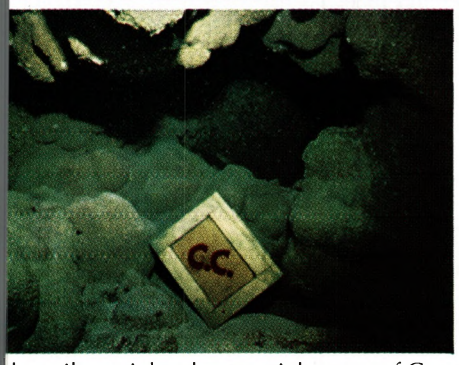
During our first dive, our guide pointed to a silver shadow above. Five feet long, half of that jaws, the menacing presence was a barracuda. Keeping a respectful distance, our search for a hiding place fanned out from the train wreck. We combed Devil's Backbone until we found a devilish hiding place for our watertight case of Canadian Club.

Seek groupers, and bring muscles.

To raise the C.C., you'll need scuba gear, guts and muscle: it weighs 200



© 1979 · 6 YEARS OLD. IMPORTED IN BOTTLE FROM CANADA BY HIRAM WALKER IMPORTERS INC., DETROIT, MICH. 86.8 PROOF. BLENDED CANADIAN WHISKY.



pounds. Start where a "dinner boat" went down on Devil's Backbone. Follow a channel across the reef to an old Ward Line steamer wreck (try this only in bright sunlight or you'll lose your boat). Take a bearing from its bow. Not more than 200 yards along, where the reef slopes into deep water and a big Nassau grouper lives, we sunk that heavily weighted, watertight case of Canadian Club. You can see exactly where it lies in the picture above.

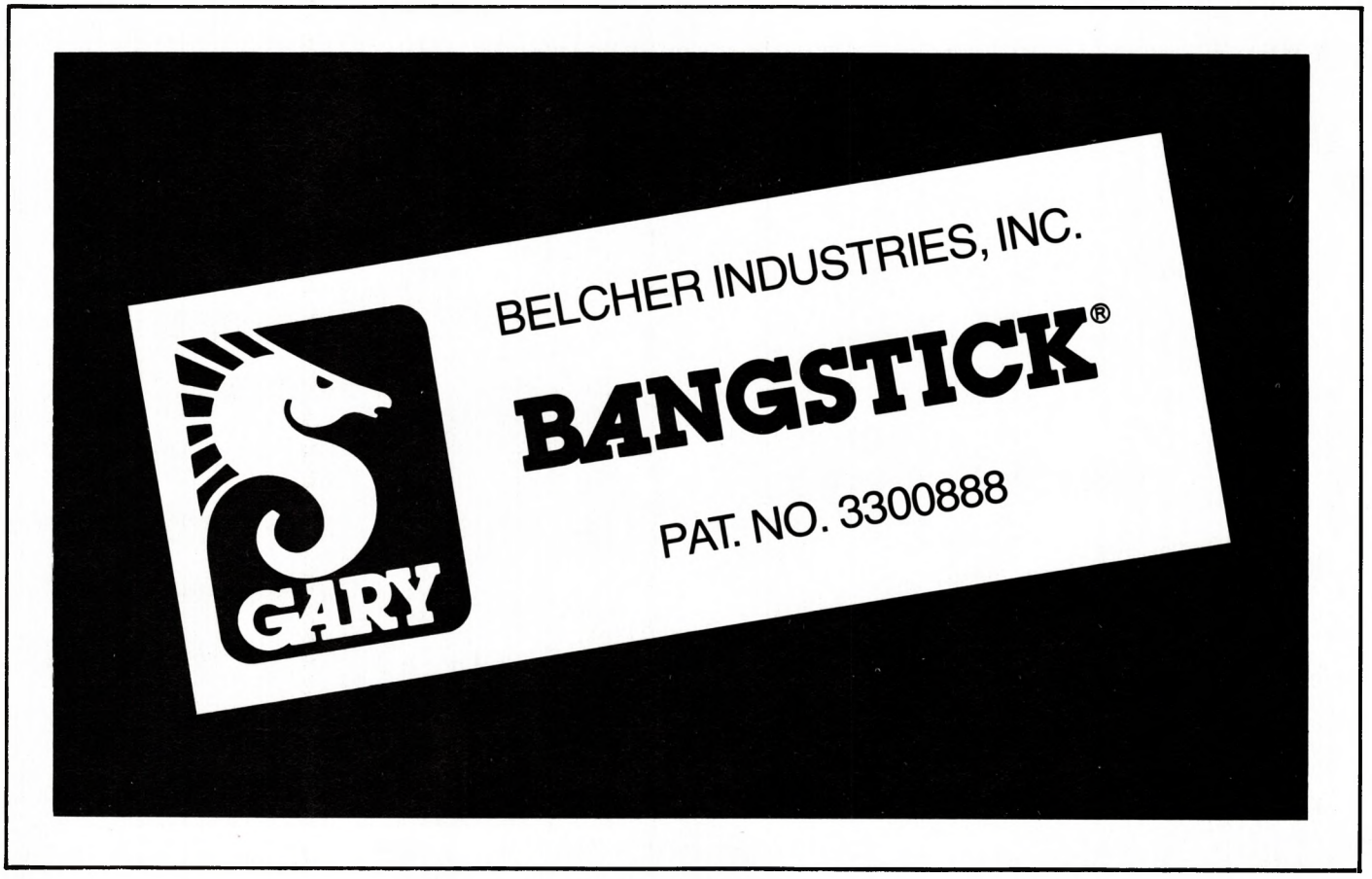
May your seas for the search be as smooth as our whisky. Note: nonswimmers may discover their own Canadian Club adventure at bars or package stores by just saying "C.C., please."



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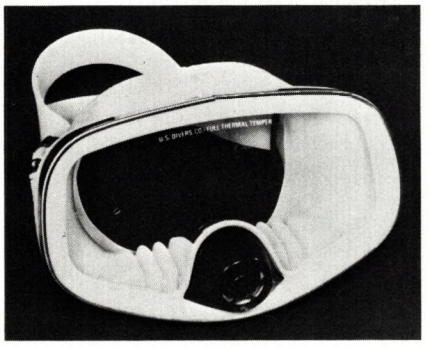
NEW & IMPROVED



New fiberglass diving helmet from Morse is certified for use by U.S. Navy divers to depths of up to 190 feet. Ball detent safety locking pins prevent accidental helmet separation, and the neutrally buoyant helmet requires no cumbersome suit or breastplate. Free flow design minimizes CO_2 build-up and silent valving allows clear audio communications. Complete helmet assembly $3000 from **Morse Diving Equipment Co., 954 Hingham St., Rockland, MA 02370.**



SeaQuest Seajacket combines quality and performance. Designed to utilize your present BC pack, Seajacket distributes buoyancy only where needed to eliminate most chest squeeze and put you in proper float position on the surface. With 25gm CO_2, $220; $209 without, from **SeaQuest, 722 Genevieve St., #N, Solana Beach, CA, 92075.**



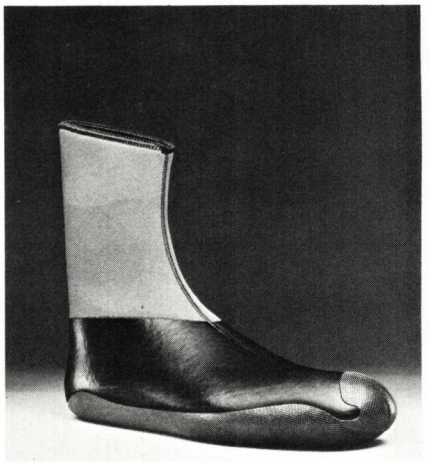
Hypo-allergenic silicone mask from U.S. Divers features translucent plate material to admit more light. New Pacifica II offers full thermal tempered faceplate and built-in purge valve. $16.50 from **U.S. Divers, 3323 W. Warner Ave., Santa Ana, CA 92702.**



Fine fit in a full coverage suit is now available in both men's and women's sizes with personalized fit. Proflex suit bends when you do and hugs like a second skin to keep you warm and comfortable. Turtleneck collar has velcro closure. Also pictured are Scubaproflex Signal Gloves and Molded Sole Boots with tread soles. Suit $220 to $240; gloves $9, boots $32, from **Scubapro, 3105 E. Harcourt, Compton, CA.**



Reserve buoyancy in Dacor's new BC could come in handy. Initial buoyancy of 25 lbs. is supplemented by 12 lbs. in reserve for a total 37 lbs. of lift. Made of ballistic nylon, the vest features automatic relief valve with quick purge and a comfortable bottom harness panel which fits over the abdomen rather than the waist. $135 with surface whistle and one 25gm CO_2 cartridge from **Dacor, 161 Northfield Rd., Northfield, IL, 60093.**



Brute Boot your suit with Poseidon's new highly protective diving boots. Nylon and neoprene Brute Boots are vulcanized and oven cured for solid, comfortable construction that won't crack or separate. Non-skid sole assures footing on wet decks and other tricky surfaces. $39.95 in six sizes from **Parkway Fabricators, 241 Raritan St., South Amboy, NJ 08879.**

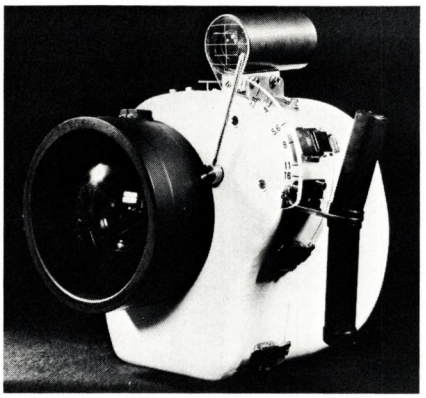
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Tough taped suits combine sturdy seams with flexible construction to assure comfort in the water or out. Colorful seam tape is applied with a special six needle mauser sewing machine for a lasting bond that will stand up to hard use. Three models $92.50, from **U.S. Divers, 3323 W. Warner Ave., Santa Ana, CA 92702.**



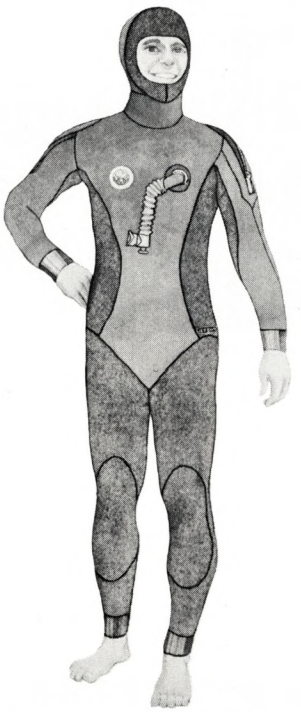
Avon Redshank offers durable, dependable service under the most adverse conditions. Chosen by the Fathom Marine Archaeological Research expedition for use in conditions of extreme heat and hazardous coral reefs, the 12-foot Avon Redshank proved to be "tough, stable and able to take hard service." Available in 18 models starting at $670 from **Imtra Corp., 4740 126th Ave. N., Clearwater, FL 33520.**



Shoot wide and fast with the IDI/ACL-4 underwater housing for 16mm Eclair ACL. With 400 foot film capacity, ACL-4 accepts 10mm, 5.9mm or 3.5mm lenses with dome correction, reflex viewing and more features than any other underwater camera system. Standard camera, cable and battery with 200 or 400 ft. magazine can be used. $4,495 from **Image Devices, Inc., 1825 NE 149th St., Box 61-0606, Miami, FL 33181.**



Double bag BC from Aqua-Lung features a tough nylon outer bag and durable urethane inner bladder for reliable buoyancy. New harness "Y" design eliminates chafing and binding. Available with 38 lbs. or 53 lbs. of lift, in yellow with black trim. $134.95 from **U.S. Divers, 3323 W. Warner Ave., Santa Ana, CA 92702.**



Jetsuit drysuit from Poseidon features an airtight across-the-shoulder entry zipper to get you in and out with ease. Made of Rubatex neoprene and soft nylon, Jetsuit's trim fit and unlined neoprene wrist and ankle seals assure comfort both in and out of the water. $450 in blue and black or orange and black from **Poseidon Systems USA, 241 Raritan St., South Amboy, NJ 08879.**



Stuff a duffle from Parkway with all your gear except tanks and dive buddy. Measuring 20" x 26" x 6", the big bag is made of tough rip-stop nylon with heavy duty wrap-around straps and a non-fouling nylon zipper. $24.95 in blue with black straps and white Parkway emblem from **Parkway Fabricators, 241 Raritan St., South Amboy, NJ 08879.**

continued



Chevy Fleetside Sport



Chevy Van Sport



Chevy Blazer

Chevy Stepside Sport

Different brutes for different routes.

Wherever you go—whatever direction your kind of fun takes you, the Brute Force will get you there. In style.

Maybe it'll be one of the exciting and popular Chevy Stepside Sport or Fleetside pickups. Maybe it'll be the brilliantly colored Chevy Van Sport or the rugged Blazer with available 4WD.

Whatever, whichever, the Brute Force is some bad bunch. Big and tough and mean. With such features as Massive Girder Beam suspension (2WD models), computer-matched brakes, and 4-wheel drive (available on Pickups, Blazer, and Suburban). The Brute Force is right there when the going gets tough.

Chevy Brute Force. Tough on or off the road.

THE BRUTE FORCE

CHEVY TRUCKS

BUILT TO STAY TOUGH



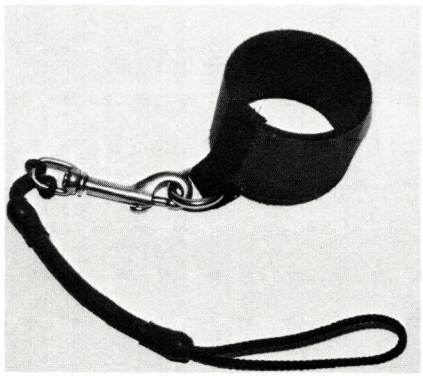
Strap on a Seamaster knife for underwater peace of mind. Redesigned for 1979, Seamaster features blunt screwdriver tip, serrated top edge, six inch scale and 300 series stainless steel blade. $23.95 with sheath in yellow, orange, black or brown from **U.S. Divers, 3323 W. Warner Ave., Santa Ana, CA 92702.**



Baby Bluefin is a small stabilizing vest designed for divers 5′ to 5′6″ tall. Tough Cordura nylon vest provides 35 lbs. of buoyancy with a comfortable harness designed to eliminate "riding up" when worn by women divers. During April participating stores offer a handsome carrying bag free with purchase. $200 with one 25gm CO_2 cartridge from **Seatec, 425 W. Palmyra, Orange, CA 92666.**



Portable depth finder by Shakespeare Marine is designed for the fisherman who rents boats. Water resistant and lightweight, the new DF-101 features improved shallow water capabilities. Low power consumption extends battery life, and high intensity flasher is easily visible even in bright sunlight. Expanded range shows fish and objects to 120 feet. $199 from **Shakespeare Marine Electronics, 2295 N.W. 14th St., Miami, FL 33125.**



Dive Tether by Johnson Sports is like having a third hand. The detachable wrist leash with marine brass snap and "O" ring securely handles cameras, lights and other accessories. $4.99 from **Johnson Sports, 12525 Crenshaw Blvd., Hawthorne, CA 90250.**



New SeaExplorer skindiving vest from U.S. Divers features tough heat sealed nylon construction, automatic overpressure release, oral inflator and sturdy one inch webbing. $37.50 with 16gm CO_2 from **U.S. Divers, 3323 W. Warner Ave., Santa Ana, CA 92702.**



Pack a Pelican Bag with a weekend's worth of gear. Four external pockets and four internal compartments expand to accommodate an incredible volume. Wide, adjustable yoke strap conceals convenient key ring clip to keep keys handy, and Velcro closures open only when you want them to. Made of Cordura nylon, the bag is waterproof, mildewproof and machine washable. $34.95 in bright red or electric blue with bold webbing stripe, from **Pelican Products, 23763 Madison St., Torrance, CA 90505.**

continued

SCOTT-JOHN

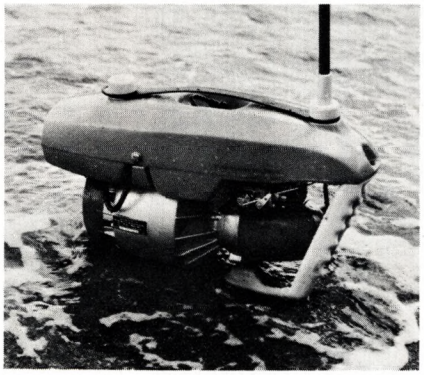


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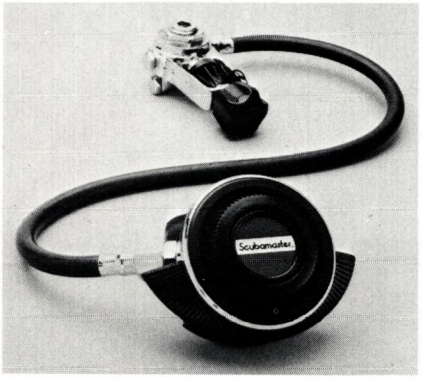
Dacor's new wrap-around BC is the only BC of its type that allows the diver to drop the tank and retain the vest. Main buoyancy in the back bladder provides 25 lbs. of lift; the front bladder carries 25 lbs. of emergency buoyancy. Each bladder has its own inflation/deflation system, over pressure relief valve and quick purge. $189 from **Dacor, 161 Northfield Rd., Northfield, IL, 60093.**



Versatile new Aquascooter pulls a diver or pushes a dive boat. Powered by a two horsepower engine, the 15 lb. craft can pull a diver along at five miles an hour for more than two hours on two liters (1.8 qts.) of gasoline. Safe enough to be used by small children, the machine can be started in or out of the water and slowly circles when released. Optional bracket allows mounting to a small boat for use as an outboard engine. Less than $300 from **Aquascooter, 43 Commerce St., Springfield, NJ 07081.**



No nonsense knives from Wenoka Cutlery feature solid rubber handles, 400 series stainless steel blades and a stainless welded butt plate with base guard to protect the hand when hammering. Left to right, the new knives are the 7901 working knife, 7902 survival knife, and a smaller version of the 7901. All are available with Wenoka's new sheath with a specially designed guide path to help resheath the knife. From **Wenoka Cutlery, 85 North Ave., Natick, MA 01760.**



Redesigned Scubamaster regulator makes the breathing easier with a new diaphragm design. Anti-friction Teflon demand lever smoothes regulator operation and a special aspiration tube generates a partial vacuum in the regulator case, reducing the amount of effort needed to breathe during high demand conditions. $166.70 from **Scubamaster, 233 E. Manville St., Compton, CA 90220.**



Chronosport Universal Diving Timer watches your bottom time. Liquid crystal display functions as a stopwatch or as a 24 hour watch which can be set to a different time zone than the dial. Quartz crystal movement assures accuracy, and a one way, ratcheted bezel gives error-free elapsed time readings. $270 from **Chronosport, 119 Rowayton Ave., Rowayton, CT 06853.**



Starstrobe Distress Light flashes 50 times per minute for 12 hours continuously on one alkaline battery. Sturdy plastic case floats upright. Electronic light remains cool to the touch, yet produces 130,000 candlepower which can be seen for miles. On-off switch can be operated with one hand. $19.95 with lanyard and red plastic lens cap from **Manumark, 7013 Perimeter Center E., Atlanta, GA 30346.**

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TS 103

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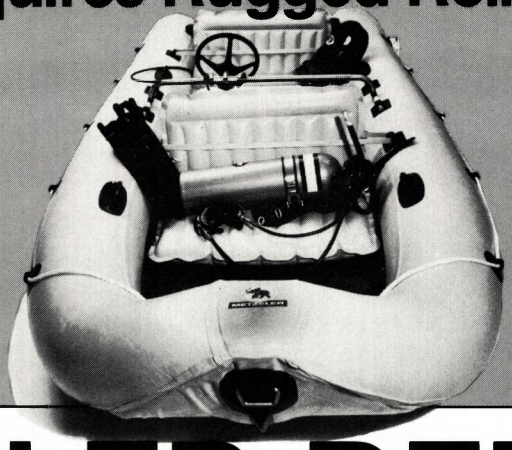


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you must have equipment you can depend on. Metzeler inflatable boats are perfect for divers being designed for performance, versatility, safety, and durability.



High carrying capacity.



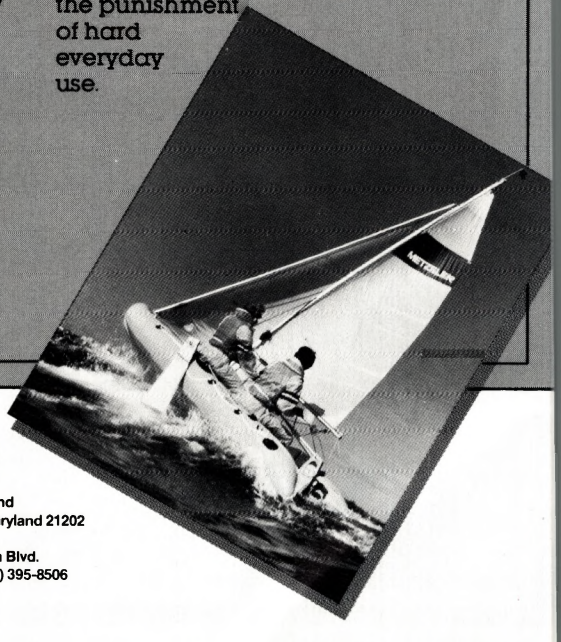
Fast under power.

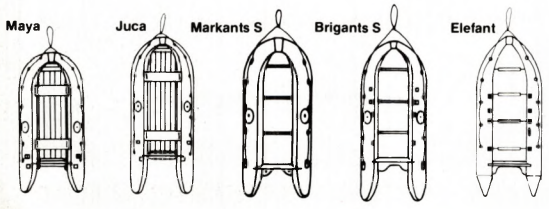
Performance. Metzeler boats have high carrying capacity, are very stable—almost impossible to capsize, and are easy to enter from the water. They are constructed to accept the highest inflation pressure in the industry making them very rigid; they are easier to row and faster under power.

Versatility. Metzeler inflatables are easy to assemble, can be launched virtually anywhere, require little maintenance, can be carried in the trunk of a car, and may be used for a variety of purposes. They are ideal for sailing, water skiing, fishing, family outings, or as dinghies, tenders, or general transport boats.

Safety. From the bright orange hull to the specially laminated fabric. Metzelers are designed with safety in mind. All models have at least three air chambers and will operate with one chamber fully deflated. Although virtually impossible to swamp, Metzelers will carry a capacity load even when full of water. Their special construction makes them highly abrasion resistant and difficult to puncture.

Durability. Constructed of a special three layer ripstop laminate, Metzeler boats are highly abrasion resistant, chemical resistant, and require little maintenance. The middle layer of the laminate is Trevira, a material used in astronauts' spacesuits because of its extreme toughness. Metzeler inflatables stand up to the punishment of hard everyday use.





For more information on Metzeler Inflatable Boats contact:

METZELER

East: Trans-Atlantic Agencies Inc., Importers and Distributors, 612 Keyser Building, Baltimore, Maryland 21202
Telephone (301) 837-6550, TWX: 710-234-1661
West: Inflatable Boat Center, 510 Santa Monica Blvd.
Santa Monica, California 90401, Telephone (213) 395-8506

The First Complete Guide to the Diving Resort Destinations of:

THE Virgin Islands

The United States and British Virgin Islands have the best of two worlds: Unlimited Caribbean diving and an American ambience.

BY RAY M. TEBOE

In a 133-square-mile area of the Caribbean are more than 100 islands, islets and cays—every one a Virgin.

Most are easily accessible, a few remote; a majority fertile, some barren. But all are spectacular; beautiful and warm as the sea which surrounds them.

Divided nearly equally between the United States and Great Britain, the two island groups are called respectively the United States Virgin Islands (USVI) and the British Virgin Islands (BVI).

The natural beauty of these islands is awesome. Craggy 1500-foot mountain peaks look down on emerald rolling hills and plateaus of neighboring islands. Docile surf pats miles of unspoiled, powder sand beaches in countless bays and inlets. Beneath the waves exist a seemingly infinite number of fish and plantlife, minute and mammoth. Living necklaces of multi-colored coral adorn isles and cays.

Local lore describes the Virgins as "the place where angels rest on their journeys between heaven and earth." To the majority of vacationers, the islands are indeed a paradise found. Here they can sail, dance, fish, snorkel and soak up some history as well as Caribbean sun. Golf, tennis, skiing and hiking are popular, and the more adventurous can dive, parasail and sample exotic native dishes and rum punch. Enticing discounts from duty-free shops astound the first-time visitor, and whether they find lodgings in a castle or a campground, the ambience is the same. Nobody could feel left out—ever—in the Virgins.

DAVID DOUBILET

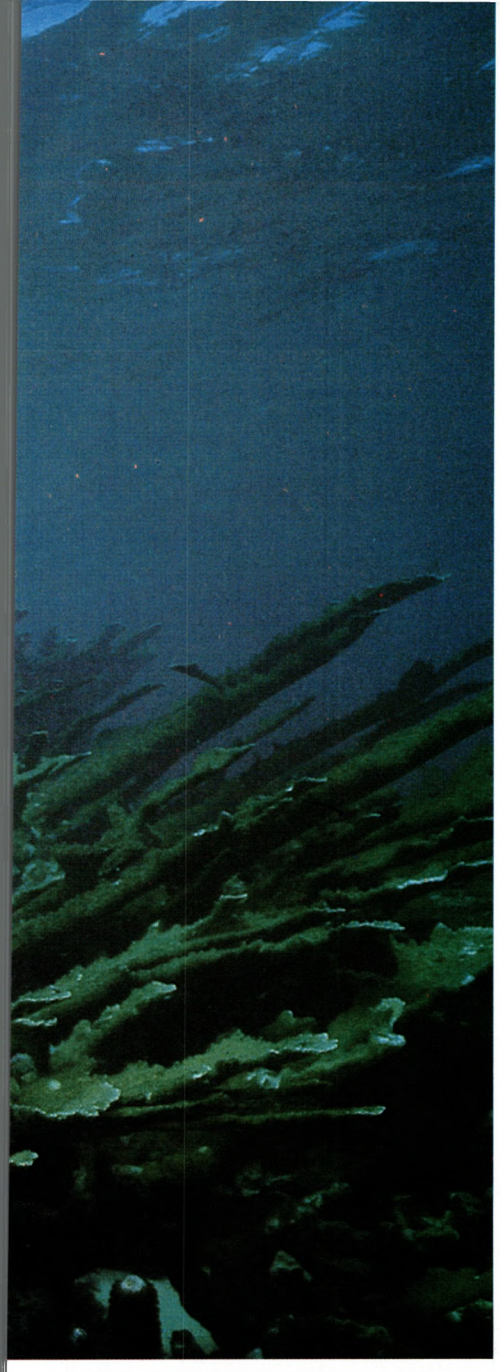


RON CUTLER

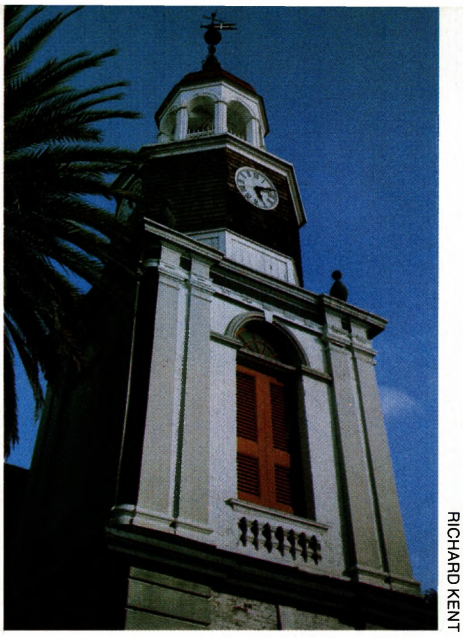


CARL ROESSLER





RICHARD H. STEWART



RICHARD KENT

Facing page, top: Snorklers at St. Croix's Buck Island National Underwater Park experience the variety of sea life in the Virgin Islands. A trail leads through the reef and along the way, prominent specimens of marine fauna marked by placards secured to the bottom. Long strands of elkhorn and brain coral like these are common in the shallow waters surrounding St. Croix. Far left: Yellow anemones and rock lobsters (left) are common among the ledges and dropoffs of the island. Above right: Architectural evidence of St. Croix's Danish beginnings is typified by this solid 19th century structure.

Buck Island Reef and a plentitude of nightlife make St. Croix the most active Virgin.

St. Croix

Lying 60 miles east of Puerto Rico, St. Croix is the largest of the American Virgins. Measuring 25 miles in length and 84 square miles in area, St. Croix could hold St. John Island and two islands the size of St. Thomas.

Known as the Garden of the Antilles, St. Croix's name has remained unchanged except for variations in spelling since 1493, although since then it has flown the flags of Spain, Holland, England, France, Malta, Denmark and the United States. Columbus named it Santa Cruz (Holy Cross). The Indians called it "Ay, Ay"—for reasons best known to themselves.

Christiansted, the capital of St. Croix, is uniquely charming among Caribbean port cities. The town's red roofs, pastel buildings, cobblestone streets and covered shopping arcades still evoke memories of its Danish architectural heritage.

Near the antique Danish governors' residence stands the hardware store in which Alexander Hamilton worked as a young boy. The original shop burned and has been replaced with another structure bearing Hamilton's name.

Ray Teboe is a freelance writer/photographer and a travel consultant for the Caribbean. Author of many travel features, his latest work appeared in ***Pace*** *Magazine.*

No hotel in Christiansted is more than three stories high, in keeping with the town's 18th century character. Guests of in-town hotels can find nearly everything they want—shopping, restaurants, nightclubs, historic sites and boats—within a five-minute walk.

Boats for sailing, island hopping, fishing, snorkeling, diving and reef-drifting are available on the Christiansted waterfront. Many of the hotel passenger boats head for Buck Island, a national monument administered by the National Park Service.

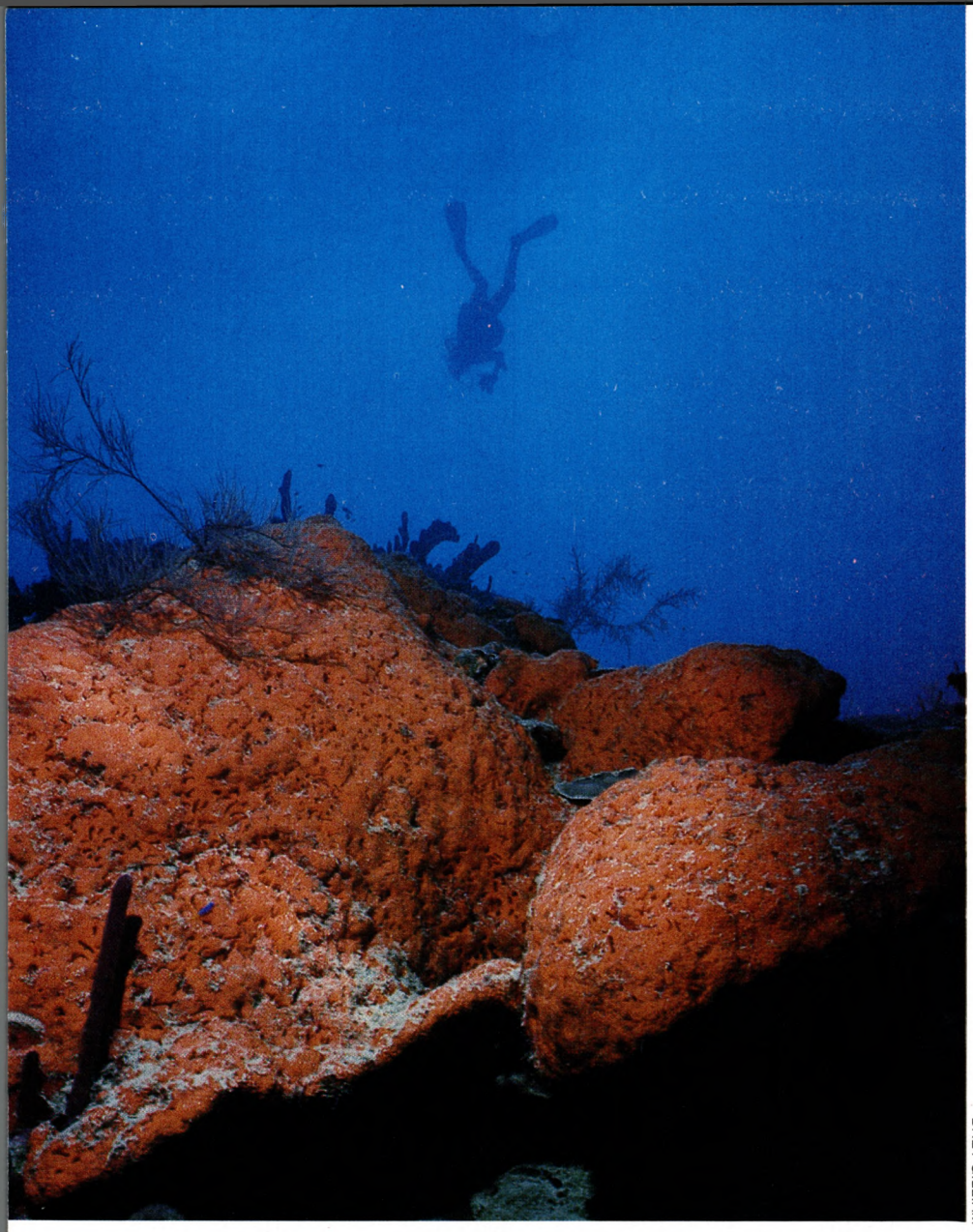
Surrounded by a shallow coral reef, Buck Island is America's only underwater national park, and the most famous submerged area in the Caribbean. Through the reef runs a well marked trail at a depth of 12 feet. Signs along the trail identify the various types of coral and fish species in the area.

During the 30-minute trail journey, a snorkeler may see french, queen and gray angelfish, blue tang, trumpetfish, yellowtail, foureye butterflies, and a variety of parrot fish.

Because of its shallow depths, the reef is popular with both novice and experienced divers. Dive operators list it as a favorite destination because of a forest of giant elkhorn coral that climbs from the bottom 40 feet to the surface.

Approximately 70,000 visitors per

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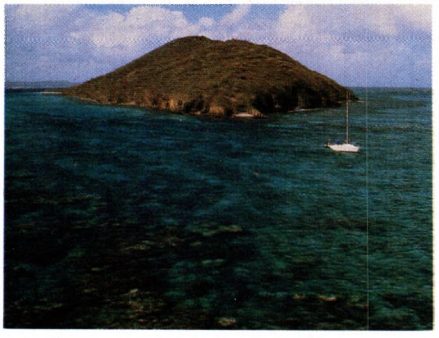
BRET GILLIAM

year make Buck Island one of the most popular diving sites in the islands. There are seven dive operators offering service from ten locations in Christiansted, Frederiksted and Cane Bay.

The combined diving fleet includes at least a dozen boats from 20 to 65 feet, accommodating six to 23 divers at a time. Island dive operators employ 16 dive guides and instructors. Eight compressors offer one, two or three tank dives, and the 65-foot dive boat has unlimited tank diving facilities for five-day, inter-island cruises.

Among the U.S. Virgins, St. Croix has the best and most varied wall diving. In many places the island drops away sharply to depths eventually reaching 12,000 feet. This creates a number of exciting drop offs for the underwater explorer.

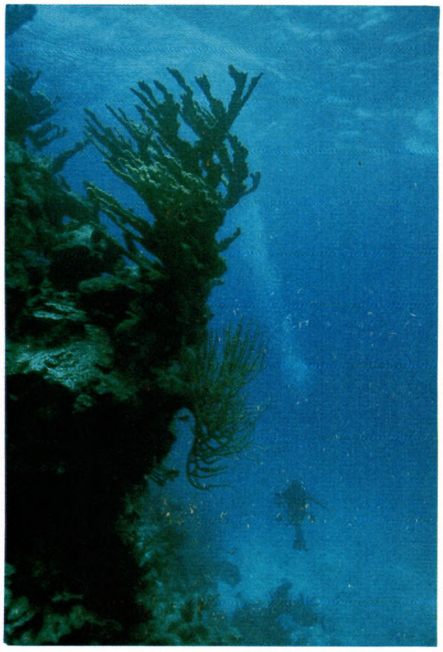
North of the Frederiksted Pier are four wall dives, including the Frederiksted Wall, the RCA Wall and the Clovercrest Wall. All three of these are fairly steep drop offs, suitable for photography and the reef formations are literally paved with growth. Depths run from 45



MIKE HANNAU



RON CUTLER



FRED BAVENDAM

Above: Buck Island and its coral lagoon are visited by an estimated 10,000 snorkelers, boaters and divers each year. Top left: This huge orange sponge, approximately six feet by five feet, is a noted feature at Cane Bay. Floating off the edge of the dropoff, it seems almost liquid. Far left: Seahorses in all shapes and sizes may be found beneath the Frederiksted Pier. The pilings are beautifully encrusted, also harboring numerous invertebrates, batfish and octopi. Left: At Salt River, a giant growth of elkhorn coral hangs precariously at the edge of the ledge. Facing page, top: The Hydrolab at Salt River is the United States' only operating underwater habitat.

feet on down and there are concentrations of reef fish and an occasional pelagic visitor.

South of the pier, King Reef offers a gentle slope beginning in 40 feet. The slope is the prototypical Caribbean reef. A veritable avalanch of hard and soft corals, sponges and gorgonians litter the area, their hues softened and subdued by the deep blue water.

At Salt River, location of the Hydro-Lab, the wall starts in less than 30 feet of water. A series of rock ledges harbor large sponges, some of the most colorful found in the islands. At the top of the wall, large elkhorn corals hold firmly to the shallow bottom, seemingly afraid of the drop into the abyss below.

At Cane Bay divers can snorkel out over huge elkhorn and pillar corals to the Cane Bay wall, less than 200 yards offshore. Near the beach, the gently sloping bottom is neatly cobbled with patches of various hard corals and gorgonians. At a depth of 50 feet, the bottom drops away, leaving you suspended over almost infinite depths.

There are other beach dives around St. Croix. Photographers will enjoy the elkhorn formations at Davis Bay Wall, while those with a culinary interest may find the plentiful conchs at Sugarloaf more attractive.

The Frederiksted Pier, extending 1000 feet into the harbor, accommodates the cruise ships that visit St. Croix. Unmatched anywhere in the Caribbean for pier diving, it ranks among the highest on the island dive operators' list of best dive sites.

Divers find a wealth of marine life under the pier, circling or clinging to its hundreds of pilings: sea horses, sponges, angelfish, wrasses, octopi and flying gunnards. Among crabs and lobsters on the bottom, you may find a relic of the 17th century in the form of a coin or bottle dropped while unloading a ship's cargo. However, as of this writing, the Frederiksted Port Authority allows pier diving only when supervised by accredited guides.

East of Christiansted on Teague Bay is the West Indies Laboratory of Farleigh Dickinson University. The lab is a tropical teaching and research station as well as a marine and terrestrial field laboratory. Open year-round for studies through the graduate level, the facility's eight-acre campus has a library, several labs, dormitories, a cafeteria and a small pool.

The laboratory provides support services for the Hydrolab at Salt River—the United States' only operating underwater habitat. It's capable of accommodating four persons for several days.

The lab also operates a complete hyperbaric treatment chamber capable of providing emergency assistance.

West of Christiansted, stretching from the north to the south lie the majority of the island's old estate plantations. Their names, each having a special but now-forgotten meaning, stir the imagination: Upper Love, Lower Love, Jealousy, Anna's Hope, Prosperity, Hard Labor, Peter's Rest, Sweet Bottom and Judith's Fancy.

One of these old plantations, Whim Greathouse, was restored in the early 1960s by the St. Croix Landmarks Society. Surrounded by a moat, the main house, with walls three feet thick, is thought to have been constructed in 1794 as the residence of a bachelor Danish planter. Furnished with elegant 18th century antiques, the house is still alive with legends of the planter's eccentric bachelorhood.

The 18th and 19th centuries were not kind to Frederiksted, St. Croix's west coast harbor town. Planned in 1751 as the commercial and social center of the island, only two houses were built in four years despite financial incentives offered builders. In 1867, a tidal wave swept away most of the town. A labor strike 11 years later was followed by a fire which destroyed most of the remaining buildings in a single day.

North of Frederiksted is St. Croix's fabled rain forest, small as forests grow, but quite primeval and dense with foliage, ferns and vines. You may drive through the forest, but it is best observed from horseback or on foot. Horses are available at nearby Estate Sprat Hall where Jill Hurd operates an equestrian academy. A moonlight ride through the forest is a special experience you'll remember for years afterward.

Wide variations of climate and topography can be found on the large



BRET GILLIAM

island. From Point Undall on the eastern tip of the island for about seven miles to the west the land is rocky, arid and dotted with cacti and scrub, receiving only 25 inches of rain a year. Broad, lush fields dominate the center of the island, rising to upland pastures and rolling hills. Most of the west, particularly the northwest, is vibrant green, averaging 53 inches of rainfall a year.

Generally, rain comes to all the Virgins in the form of sporadic showers throughout the year. There is no true rainy season here, although October is occasionally a little wetter than other months. No place in the islands is very far from water, and sea breezes provide a moderate change in daily temperature of 10 to 15 degrees on St. Croix. But seasonal temperature changes vary little, resulting in a mean annual temperature from the mid 70s to the mid 80s.

In the recent past, St. Croix has been referred to as a "beautiful lady, most sedate in her ways." But today the lady, still as beautiful, has left her rocking chair to swing on the island's new tennis courts and dance floors of the new discos in her towns.

Tourists can choose from several types of accommodations: large and small hotels, apartments, condominiums, guest houses, cottages and villas. Action packages geared to special interests such as tennis, golf or diving are always available.

The whole world has access to the Virgins through connecting flights from mainland U.S. cities and San Juan, Puerto Rico. Convenient inter-island flights are offered by Prinair, Aero Virgin Islands, Air BVI, Air Caribbean and Trans Commuter Airlines.

continued



ILLUSTRATIONS: DON WARREN



ST. CROIX

GENERAL

Location: 60 miles east of Puerto Rico and 40 miles south of St. Thomas
Size: 84 square miles
Topography: a hilly island with seaside cliffs
Climate: subtropical with 50 inches of precipitation annually
Population: 89,620
Largest towns: capital Christiansted, Frederiksted
Languages: English, Spanish
Ethnic composition: 75% black, 25% other
Economy: 10% agricultural, 20% industrial, 70% tourism
Monetary unit: U.S. dollar
Diving season: year-round
Tourist season: year-round

DIVING

Water temperature: winter 75-78, summer 82-84°F
Visibility: 100-110 feet
Depth of dives: 30-100 feet
Currents: 0-½ knot
Tidal fall: 1 foot
Types of diving: reef, wreck, wall, night, beach
Skill level: novice, intermediate, advanced
Dives per day: 4
Diving craft: excellent
Sights:
- Fish: angel fish, grunts, Nassau grouper, jack, eel, rays, dolphins, spotted eagle rays
- Coral: sea fans, gorgonians, black coral in shallow water, staghorn, elkhorn, brain, pillar
- Sponges: basket, tube, vase
- Shells: conch, trident, trumpet, helmet, coon, welk
- Invertebrates: octopi, squid, nudibranchs

Restrictions: lobster limit two per day; no coral may be taken

DIVING SERVICES

Instruction available: resort course, open-water certification, advanced open-water certification, underwater photography
Equipment rental: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, BC with inflator, pressure gauge, depth gauge, compass, decompression meter, full wet suit, partial wet suit, knife, game bag, dive light, Nikonos, camera housing, underwater strobe
Equipment sales: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, BC with inflator, pressure gauge, depth gauge, compass, decompression meter, full wet suit, partial wet suit, knife, game bag, dive light, Nikonos, camera housing, underwater strobe
Equipment repair: good
Camera repair: fair
Air: to 5000 psi
Guides: excellent

DIVERSIONS

Ground transportation: bus, taxi, rental car, motorbike, bicycle
Shopping; excellent and reasonable
Restaurants: excellent and reasonable, average dinner $10-15
Nightlife: excellent
Other sports: fishing, golf, tennis, bowling, horseback riding
Don't miss: Buck Island Reef, West Indies Lab, Frederiksted Pier

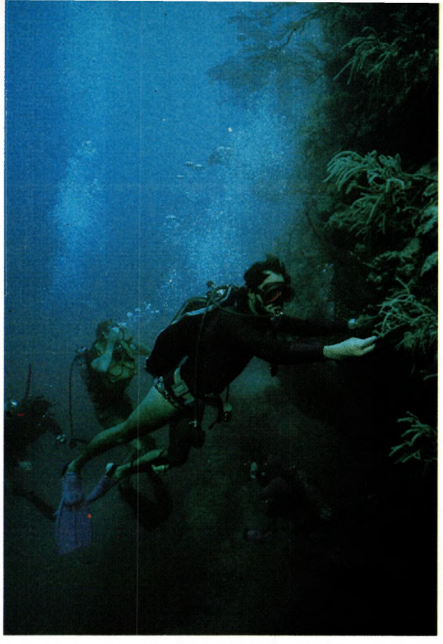
JUST IN CASE...

Hospitals: Charles Harwood Memorial Hospital, Christiansted 773-1212; Nesbitt Clinic, Frederiksted 772-0211
Diving doctors: Bill Shone, M.D., West Indies Lab
Recompression facilities: Farleigh Dickinson University, St. Croix
Police: Christiansted 773-4035; Frederiksted 772-0211
Marine Rescue: Coast Guard, Coast Guard Auxiliary, REACT all monitor VHF and CB frequencies
American Express: American Express, Caravelle Arcade, Christiansted 773-7777
U.S. Consulate: none

PLANNING

Diving tours: Above and Below, 10 Strand St., Frederiksted; Caribbean Sea Adventures, Box 3015, Christiansted; North Star Diving Tours, Box 3461, Christiansted; Pressure Limited, Box 3612-A, Christiansted; Salty Dogs, King's Wharf, Christiansted; V.I. Divers, Ltd., Pan Am Pavilion, Christiansted
On your own: Airlines—Air Florida, 3900 NW 79th Ave., Miami, FL (305) 592-8010; Eastern Airlines, 4200 NW 36th St., Miami, FL, (305) 873-3000; American Airlines, 25 SE 2nd Ave., Miami, FL, (305) 371-4417
Airports: Alexander Hamilton Airport, South Shore
Marinas: St. Croix Marina (ships' chandlery); St. Croix Yacht Club
Accommodations: King Christian Hotel, 59 King's Wharf, Christiansted; Buccaneer Hotel and Beach Club, Box 218, Christiansted; Grapetree Beach Hotel, Box "Z", Christiansted; Anchor Inn, 58 King St., Christiansted; Cane Bay Plantation, Box "G", King's Hill; Spratt Hall, Box 695, Frederiksted
Campgrounds: Cinnamon Bay, Box 120, St. Croix; Maho Bay Camp, Box 113, St. Croix
Customs and Immigration: Requirements—none
Import restrictions: none
How much cash may you bring into the country? Amounts over $5000 must be declared
Export restrictions: none
U.S. Customs re-entry restrictions—$600 worth of goods may be brought back duty free
Bibliography: **St. Croix Settlers' Handbook,** Prestige Press; **Diving Guide to the Virgin Islands,** Glanville & Jenik; **The U.S. Virgin Islands,** Hans W. Hannau, **Fodor Travel Guide; Fieldings Travel Guide; Berlitz Travel Guide**

Where a notation "fair," "good," or "excellent" appears after an item, such as guides or diving craft, it refers to the *availability* not the quality of the services.



STEPHEN EARLEY

Camping and diving mix where St. John's national park meets the sea.

St. John

St. John is the smallest of the major American Virgins. The fabulous natural beauty of the island has been undisturbed for centuries excepting a brief period of colonization in the 18th century. Today, most of the island is a National Park.

A small waterfront town on Cruz Bay is the administrative center of the island. Ferries from St. Croix and St. Thomas call here, disembarking passengers among the few small stores that huddle around the Virgin Islands National Park Headquarters. There are some 30 other bays indenting St. John's shoreline, and most are excellent dive sites.

Caneel Bay washes the shores of a resort acclaimed to be the finest in the Caribbean. The Caneel Bay plantation has 150 rooms, many in villas overlooking the seven tropical beaches surrounding its peninsula. For each room there is more than an acre of grounds.

Although the Plantation is within the boundaries of the national park, few park visitors are guests of the resort. It is a favored playground for some of the world's wealthiest persons. They come here to enjoy the remote privacy, service and facilities (including the only seven tennis courts on the island) at rates that astound most park visitors.

North of Caneel, Trunk Bay boasts "the world's original underwater nature trail". At a depth of 12 feet, the trail runs a 200 yard course through magnificent coral formations and marine life. Two miles out, divers find lobster, and have no trouble catching the daily limit of two. The National Park Service provides a lifeguard, picnic tables, dressing rooms and other visitor comforts.

Unlike many Caribbean islands, St. John welcomes campers. Resort courses in scuba and free-diving are available at Maho Bay. This 14-acre wooded hillside camp overlooks Maho Bay, and caters to those who want to vacation naturally. Guest accommodations are canvas-roofed shelters secured to wooden platforms. These shelters are cantilevered into the hillside above the ocean, surrounded by undisturbed island flora.

Cinnamon Bay, north of Trunk Bay is a watersports center where sailing, diving and free-diving trips originate. This camp offers two ways to go. You can rent a spartan cottage with beds, table, charcoal grill and electric light; or opt for a bare site with tent, cots, table and charcoal grill.

Directly offshore of Cinnamon Bay is a sloping coral formation featuring various hard corals—including elkhorn—and excellent fish life. Exploring the ocean side of this reef, where the best corals lie, would put you in 65 to 80 feet of clear water.

St. John has excellent shallow-water diving—perfect for novice divers, free-diving or shallow photography—at several locations. Watermelon Cay on the north side, Steven Cay on the west side and Reef Bay on the south side are the most popular of these.

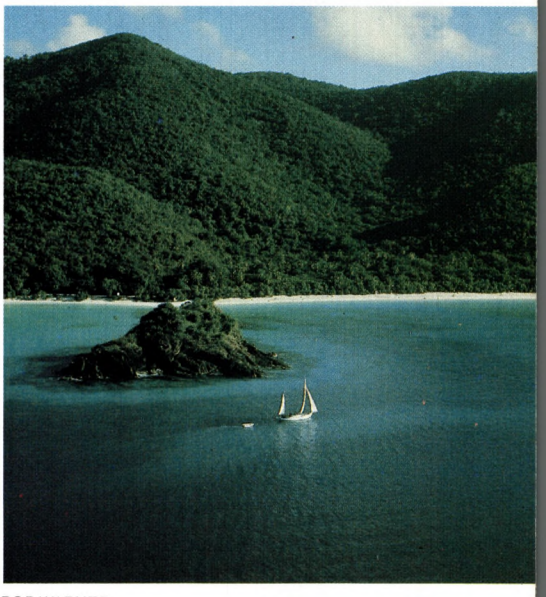
More typical of St. John's underwater topography are the rocky ledges found at Carval Rock on the northwest side of the island. Here a rock canyon with steep sides is patrolled by schools of pelagic gamefish such as tarpon. The rock is volcanic, and in places is covered with hard corals in depths from 20 to 90 feet.

Most visitors come to St. John for a day to take a guided tour of the Park by safari bus or jeep, as well as swim, snorkel or hike.

St. John's best vantage point is Coral Bay Overlook above Hurricane Hole, a deep natural harbor in which ships once sought protection from hurricanes. You can look northward from the Overlook, across Sir Francis Drake Channel, and see about a dozen of the British Virgin Islands.

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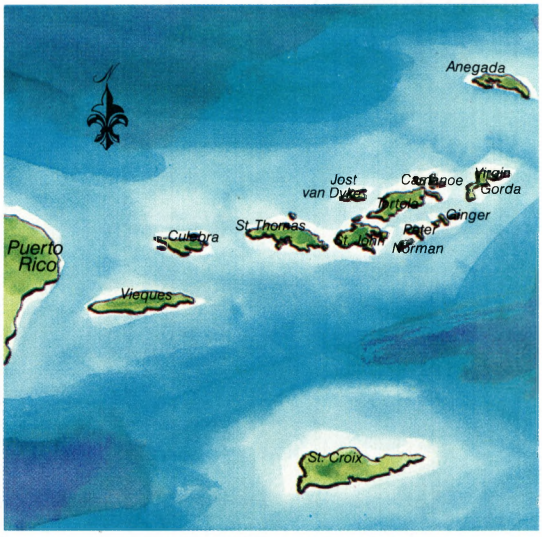
MIKE HANNAU



BOB WARNER



Top: From Cinnamon Bay, St. John rises almost vertically. Much of St. John is a National Park, and visitors can choose to stay at a campground at the park's edge. Hotel accommodations are available as well, and both are convenient to both the park and the several diving operators on the island. Above: These grunts are protecting their territory by confronting an invader and making the peculiar sound for which they were named.



ILLUSTRATIONS: DON WARREN



ST. JOHN

GENERAL

Location: 4 miles east of St. Thomas
Size: 27 square miles
Topography: a hilly island
Climate: subtropical with 40 inches of precipitation annually
Population: 2,269
Largest towns: none, approximately two-thirds of the island is a National Park
Languages: English
Ethnic composition: 75% black, 25% other
Economy: 100% tourism
Monetary unit: U.S. dollar
Diving season: year-round
Tourist season: year-round

DIVING

Water temperature: winter 75-78, summer 82-84°F
Visibility: 100-110 feet
Depth of dives: 30-100 feet
Currents: 0-½ knot
Tidal fall: 1 foot
Types of diving: reef, wreck, wall, night
Skill level: novice, intermediate, advanced
Dives per day: 4
Diving craft: excellent
Sights:
- Fish: angelfish, grunts, Nassau grouper, jack, eel, rays, dolphins, spotted eagle rays
- Coral: sea fans, gorgonians, black coral in shallow water, staghorn, elkhorn, brain, pillar
- Sponges: basket, tube, vase
- Shells: conch, trident, trumpet, helmet, coon, welk

Restrictions: lobster limit two per day; no coral may be taken

DIVING SERVICES

Instruction available: resort course, open-water certification, advanced open-water certification, underwater photography
Equipment rental: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, BC with inflator, pressure gauge, depth gauge, compass, decompression meter, full wet suit, partial wet suit, knife, game bag, dive light, Nikonos, camera housing, underwater strobe
Equipment sales: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, BC with inflator, pressure gauge, depth gauge, compass, decompression meter, full wet suit, partial wet suit, knife, game bag, dive light, Nikonos, camera housing, underwater strobe
Equipment repair: good
Camera repair: none
Air: to 5000 psi
Guides: excellent

DIVERSIONS

Ground transportation: bus, taxi, rental car, motorbike, bicycle
Shopping: good and reasonable
Restaurants: excellent and reasonable, average dinner $10-15
Nightlife: none
Other sports: fishing, sailing
Don't Miss: St. John National Park; Coral Bay Overlook

JUST IN CASE...

Hospitals: Morris F. DeCastro Clinic, Cruz Bay, St. John (809) 776-6252
Diving doctors: none
Recompression facilities: Farleigh Dickinson University, St. Croix
Police: ph—915
Marine Rescue: VI Search and Rescue ph—774-8282
American Express: American Express Bldg., Main St., St. Thomas 774-0935

PLANNING

Diving tours: Caneel Bay Plantation, St. John; Island School of Underwater Photography, Red Hook; M.V. Unwinders, Maho Bay Campground, St. John; ScubaVentures, Ltd., Caneel Bay Plantation, St. John; St. John Watersports, Box 161, Cruz Bay, St. John; St. Thomas Diving Club, Box 4976, St. Thomas
Land Tours: Tropic Tours, International Plaza, St. Thomas (809) 774-1855
On your own: Airlines—Eastern Airlines, 4200 NW 36th St., Miami, FL (305) 873-3000
Airports: Harry S. Truman Airport, St. Thomas
Accommodations: Caneel Bay Plantation, Box 120, St. John; Serendip Apartments, Box 273, St. John
Campgrounds: Maho Bay Campground, Cinnamon Bay Campground
Customs and Immigration: Requirements—none
Import restrictions: none
How much cash may you bring into the country? Amounts over $5000 must be declared
Export restrictions: none
U.S. Customs re-entry restrictions—$600 worth of goods may be brought back duty free
Bibliography: **Diving Guide to the Virgin Islands,** Glanville & Jenik; **The U.S. Virgin Islands,** Hans W. Hannau

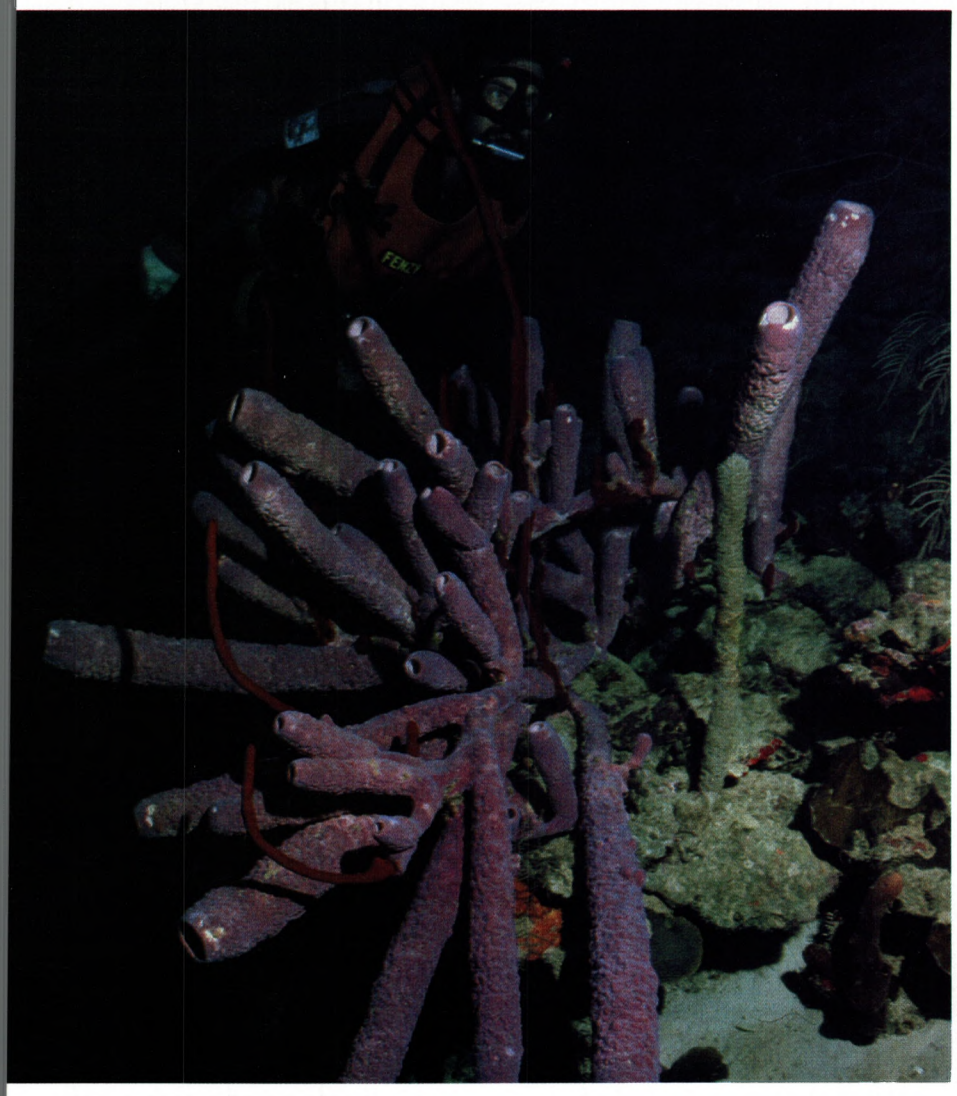
Where a notation "fair," "good," or "excellent" appears after an item, such as guides or diving craft, it refers to the *availability* not the quality of the services.



BRET GILLIAM

On St. Thomas visitors enjoy varied wreck diving and load up on bargains in the duty-free shops.

St. Thomas



CARL ROESSLER

Charlotte Amalie (ah-MAHL-ya), St. Thomas' only city, is the year-round destination of many cruise ships. For centuries this port city has been the crossroads of the Caribbean for merchants, generals, pirates, royalty, pioneers and vacationers. St. Thomas became the busiest harbor in the Caribbean in the days of the great sailing ships.

From the air, the harbor appears to embrace Hassel and Water Islands within its grasp. The smaller of the two, Hassel Island is distinguished by a mountaintop fort built in the 1800s as a signal tower. Water Island, nearly two miles long, features one of St. Thomas' most luxurious hotels. During World War II, U.S. Navy divers trained on the island, now a honeymoon resort.

Across the harbor stands the St. Thomas Diving Club. The club occupies Villa Olga, an old West Indian residence and former Russian consulate on a secluded peninsula within walking distance of town. Three dive operators are based here.

continued



RON CUTLER



MIKE HANNAU

Top left: At Coral World, off Coki Point, visitors descend into the sea by means of a partially submersed tower. The viewing area overlooks a coral reef complete with curious rays and, of course, divers. Left middle: These giant tube sponges are typical of the many large sponges found along the dropoffs in the Virgin Islands. Filter feeders, to attain this size, require a somewhat exposed location in nutritionally rich waters. Left: The harbor at Charlotte Amalie.



MIKE HANNAU

Terraced into the hillsides above the city are thousands of homes in countless pastels. Charlotte Amalie's first homes on the hilltops belonged to wealthy merchants whose waterfront warehouses bulged with European merchandise. The merchants bought their wares at a substantial discount from pirates visiting the port between raids. Captain Kidd and Blackbeard were among these visitors.

Charlotte Amalie is a walking town. Shops and historical landmarks are comfortably accessible on foot, along cobblestone streets named Kronprindses Gade, Willelskaft and Dronninggens. Most streets also have English names, and some bear American-precise names such as Post Office Alley.

Here,. small is beautiful. Nearly everything a visitor needs can be found on foot, and a taxi ride the length of the island takes only minutes. The second largest of the American Virgins, St. Thomas is about eight miles long by three miles wide. An east-to-west mountain range neatly bisects the island, between the Caribbean and the Atlantic.

St. Thomas became a free port in 1724, and has been a popular shopping stop ever since. Now that the duty-free limit for U.S. citizens has been raised from $200 to $600 in the USVIs, bargain hunters may take home more fashions, perfume, liquors, watches and china—items generally bearing the highest import duties. The new customs regulations also allow island-made products, antiques more than 100 years old and original paintings to be brought home duty free. Experienced shoppers advise, "When in doubt, buy booze." Liquors distilled and bottled in the islands are among the least expensive and best bargains.

Be sure to take a break at the famous Mountain Top Restaurant as you explore St. Thomas' highlands. A thousand feet below lies Magens Bay on the north shore, a beach whose beauty is unchallenged by any on earth. Stretching out to the horizon, the British Virgin Islands hover silently in the distance.

Houses of worship are among the oldest landmarks on St. Thomas. Rebuilt ten years ago, the Nisky Moravian Mission was founded in the 17th century. The second oldest synagogue in the New World was rebuilt in the 1830s on the site of previous Jewish temples. One of the older temples may have included among its membership Gabrial Milan, a 17th century island governor. The Frederick Lutheran Church is thought to be the second oldest in the Western Hemisphere, and the Dutch Reform Church is one of the oldest of its faith in the New World.

St. Thomas' beaches have been described as the finest in the Caribbean—and in the world. Magens Bay, with its mile-long, gently curving beach, attracts many visitors. But the most frequented by divers is Coki Beach.

The water surrounding Coki Point is unusually calm and clear. About 150 feet from the beach the bottom gradually drops off, and the shallows between the dropoff and the beach are favored by novice divers and snorkelers.

Just off Coki Point, Coral World is a marine complex with an underwater observation area overlooking a coral reef. The reef is illuminated for night observation. Sharks, rays, giant eels and barracuda can be seen through the plate glass windows. Visitors can search oysters for cultured pearls in Coral World's Pearl Bar.

Divers staying on St. Thomas can dive the Caribbean and the Atlantic on the same day. Here, you'll find no shortage of facilities; 11 dive operators work from 12 locations on St. Thomas alone. Boats from St. Thomas and St. John frequently visit the same dive sites, and between the two islands 22 boats are available in sizes from 19 to 68 feet. Most of the more than 40 guides and instructors can be found on St. Thomas, and the two islands have 19 compressors and unlimited tanks. Island School of Underwater Photography in Red Hook offers instruction in 35mm still and 8mm movie photography.

Spectacular caves, tunnels, sea mountains and at least 30 reefs keep diving visitors to St. Thomas busy. But wreck diving here is among the best in the islands. South of St. Thomas, off Saba Island, lies the Grain Wreck. Once an underwater demolition team training site, the wreck lies on its side at about 130 feet, surrounded by an extraordinary variety of marine life. Sunk in 1930, the wreck is named after the cargo she carried with her to the bottom.

The U.S. Coast Guard's *General Rogers* lies in an upright position at 65 feet between St. Thomas and Thatch Cay. Its steel hull is still intact.

In his book, *Diving Guide to the Virgin Islands,* St. Thomas dive operator Armando Jenik describes two lesser-known wrecks worth a visit. The *Caridad* is a steel hull vessel lying in shallow water off Great St. James Cay, southeast of St. Thomas. Jenik cautions divers to "check anchorage carefully, as the prevailing winds can be a hazard." The *Santa Monica,* an 18th century vessel, lies in shallow water in St. John's Round Bay. This wreck has been extensively excavated, exposing its main timbers and rows of wooden storage casks.

Guest accommodations on St. Thomas range from the plush 300-room Frenchman's Reef, the island's largest, to smaller hotels, apartments, villas, cottages and housekeeping units. Twelve hotels offer tennis on a total of 35 courts, and two public courts are available. In December, the island's first 18 hole golf course will be completed.

The island is a boater's dream. Here you can charter your own bareboat sloop, or cruise the Caribbean with a professional captain and crew. Smaller boats are available for day sails to nearby destinations such as Buck Island.

In the Virgins, sportfishing is synonymous with St. Thomas. The latest of 19 current International Game Fish Association world records set here was a 1282-pound blue marlin, landed in 1976. Fishermen pull in big blue marlin from early spring to fall. White marlin up to 200 pounds run in the summer, and winter brings catches of sailfish and wahoo.

Fishing, sailing, shopping and scuba—on St. Thomas they combine to offer the sportsman a varied and entertaining vacation.



ILLUSTRATIONS: DON WARREN



ST. THOMAS

GENERAL

Location: 40 miles east of Puerto Rico
Size: 27 square miles
Topography: a hilly island with sloping beaches and seaside cliffs
Climate: subtropical with 40 inches of precipitation annually
Population: 43,447
Largest towns: capital Charlotte Amalie
Languages: English
Ethnic composition: 75% black, 18% white, 7% other
Economy: 99% tourism
Monetary unit: U.S. dollar
Diving season: year-round
Tourist season: year-round

DIVING

Water temperature: winter 75-78, summer 82-84°F
Visibility: 100-110 feet
Depth of dives: 30-100 feet
Currents: 0-½ knot
Tidal fall: 1 foot
Types of diving: reef, wreck, wall, night
Skill level: novice, intermediate, advanced
Dives per day: 4
Diving craft: excellent
Sights:
- Fish: angelfish, grunts, Nassau grouper, jack, eel, rays, dolphins, spotted eagle rays
- Coral: sea fans, gorgonians, black coral in shallow water, staghorn, elkhorn, brain, pillar
- Sponges: basket, tube, vase
- Shells: conch, trident, trumpet, helmet, welk

Restrictions: lobster limit two per day; no coral may be taken

DIVING SERVICES

Instruction available: resort course, open-water certification, advanced open-water certification, underwater photography
Equipment rental: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, BC with inflator, pressure gauge, depth gauge, compass, decompression meter, full wet suit, partial wet suit, knife, game bag, dive light, Nikonos, camera housing, underwater strobe
Equipment sales: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, BC with inflator, pressure gauge, depth gauge, compass, decompression meter, full wet suit, partial wet suit, knife, game bag, dive light, Nikonos, camera housing, underwater strobe
Equipment repair: good
Camera repair: excellent
Air: to 3000 psi
Guides: excellent

DIVERSIONS

Ground transportation: bus, taxi, rental car, motorbike, bicycle
Shopping: good and reasonable
Restaurants: excellent and reasonable, average dinner $10-15
Nightlife: good
Other sports; fishing, sailing, tennis
Don't Miss: Charlotte Amalie historic sites; Coral World

JUST IN CASE...

Hospitals: Knud Hanson Hospital, Charlotte Amalie, St. Thomas (809) 774-1321
Diving doctors: none
Recompression facilities: Farleigh Dickinson University, St. Croix
Police: ph—915
Marine Rescue: VI Search and Rescue, ph—774-8282
American Express: American Express Building, Main Street ph—774-0935

PLANNING

Diving tours: Aqua Action, Wintberg Peak, St. Thomas; Caribbean Divers, Red Hook, St. Thomas; Island School of Underwater Photography, Red Hook; Joe Vogel Diving Company, Box 7332, St. Thomas; Ocean Adventures at Bolongo, Box 3381, St. Thomas; R.V. Black Coral, St. Thomas; St. Thomas Diving Club, Box 4976, Charlotte Amalie; Undersea Center, Frenchman's Reef Hotel, St. Thomas; Virgin Islands Diving School, Box 9707, St. Thomas; Watersports Center, Box 2432, St. Thomas
Land Tours: Grayline by United Tours, Inc., Box 4938, St. Thomas; Tropic Tours, International Plaza, St. Thomas (809) 774-1855
On your own: Airlines—Eastern direct from Miami; 4200 NW 36th St., Miami, FL (305) 873-3000
Airports: Harry S. Truman Airport, St. Thomas
Cruise Lines: Carnival Cruise Lines, 820 Biscayne Blvd., Miami, FL 33132; Holland America Cruises, 2 Pennsylvania Plaza, New York, NY 10001; Norwegian Caribbean Lines, 1 Biscayne Tower, Miami, FL 33131; Royal Caribbean Cruise Lines, 903 South America Way, Miami, FL 33132; Commodore Cruise Lines, 1015 North America Way, Number 205, Miami, FL 33132; Sigma Cruises, 10100 Santa Monica Blvd., Los Angeles, CA 90067.
Marinas: Johnny Harms' Lagoon Marina, Red Hook, St. Thomas (809) 775-0570
Accommodations: Bolongo Bay Beach Hotel, Box 340, St. Thomas; Magens Point Hotel, Magens Bay Rd., St. Thomas; Pineapple Beach Hotel, Box 2516, St. Thomas; Frenchman's Reef Hotel, Box 7100, St. Thomas; Limetree Beach Hotel, Box 7307, St. Thomas
Campgrounds: Hull Bay Campground, Hull Bay, St. Thomas; Larry's Hideaway, Box 570, St. Thomas
Customs and Immigration: Requirements—none
Import restrictions: none
How much cash may you bring into the country? Amounts over $5000 must be declared
Export restrictions: none
U.S. Customs re-entry restrictions—$600 duty free limit

Where a notation "fair," "good," or "excellent" appears after an item, such as guides or diving craft, it refers to the *availability* not the quality of the services.



Explore the Caribbean. From the bottom up.

Dive through sunken grottoes in hidden coves. Amid undersea castles and derelict sailing ships. In waters clear as emerald and teeming with marine life.

We at National combed the islands to bring you the seven ultimate aquatic packages of the Caribbean. Most of them offer other sports as well as daily diving with boat and guide. So you'll just have to dive into them, literally, to know how great they are.

Prices are per person, double occupancy, 4/15 to 12/14/79. Airfare not included.

Tortuga Club. The Caymans. Underwater Castle and famous shipwreck. 7 nights. Daily breakfast and dinner. $410.

Bob Soto's Lodge. The Caymans. Live coral reef offshore. 7 nights. Daily breakfast and dinner. $245.

The Current Club, North Eleuthera, The Bahamas. Snorkeling, water skiing, too. 7 days. Private cottages; 3 meals daily. $348.

Anthony's Key Resort, Roatan, Honduras. For experts and beginners. Certified instructors on staff. Tahitian-style bungalows. 7 nights. $369.

Club Caribbean, Runaway Bay, Jamaica. 7 nights. Private cottage. Daily breakfast and dinner. Nightly entertainment and disco. $330.

The Seven Mile Beach, The Caymans. Dive with Bob Soto and his crew. 7 nights at the Beach Colony Club, Cayman Sands Village, Holiday Inn or The Royal Palms. From $240 to $350.

Dive Bonaire/Flamingo Beach Hotel, Bonaire, Netherlands Antilles. Underwater salt flats that change color. 7 nights. Breakfast and dinner daily. $326.

For complete information mail to:
Manager of Sports Sales, National Airlines,
P.O. Box 592055/AMF, Miami, Florida 33159.

Name _____

Address _____

City/State/Zip _____

My Travel Agent is _____

National Airlines

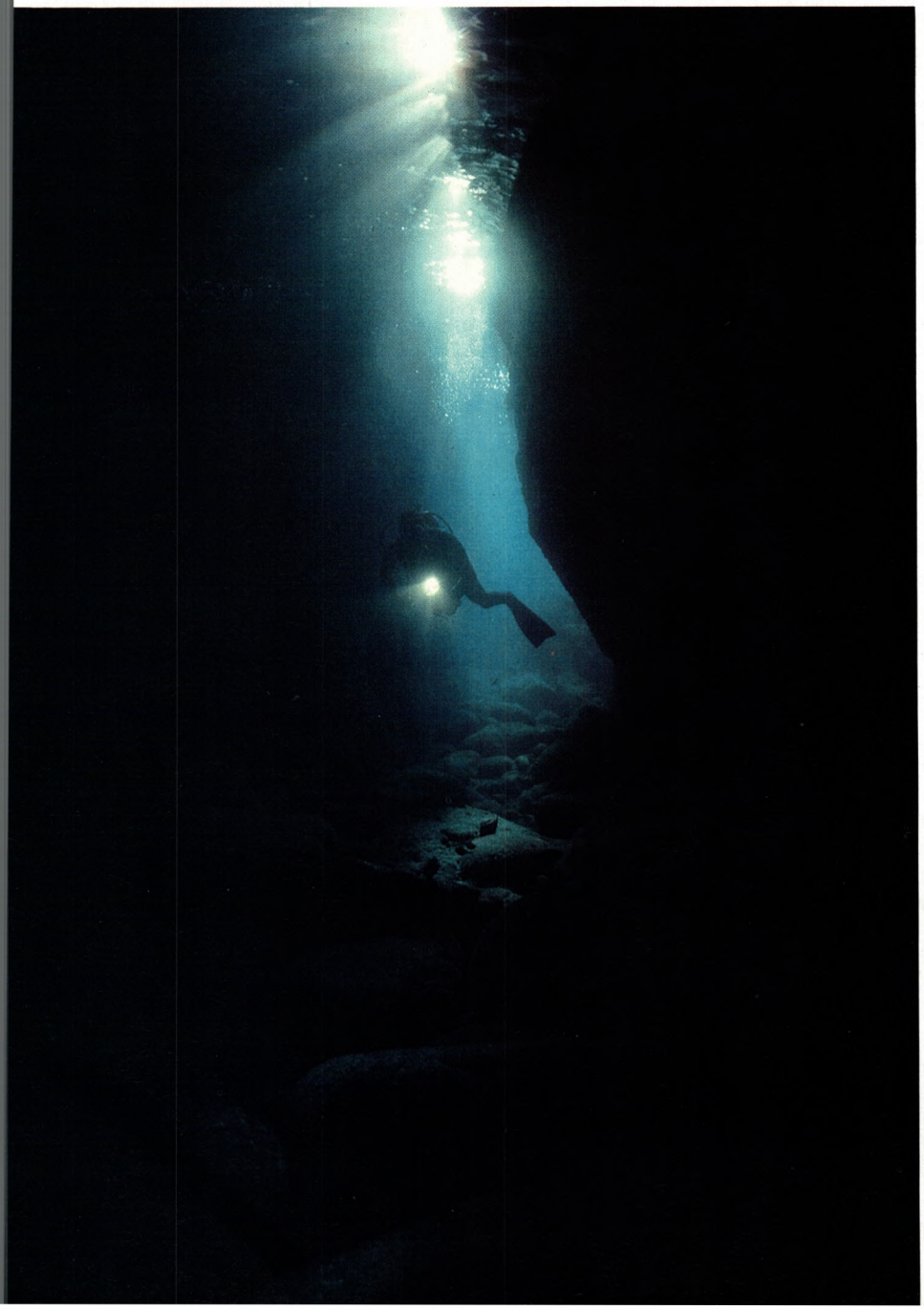
Although quieter topside, the British Virgin Islands have as much to show the diver as their American neighbors—including the ***Rhone.***

Tortola/ Virgin Gorda



DAVID DOUBILET

Below: The Baths on Virgin Gorda are popular with snorkelers, swimmers and divers. The huge granite boulders cover large, cavernous recesses reaching down 30 to 40 feet. Above right: Columbia Pictures' film ***The Deep*** *made the coral-encrusted wreck of the* ***Rhone*** *one of the world's most famous shipwrecks.*



DAVID DOUBILET

The Sir Francis Drake Channel is the boundary between the United States and British Virgin Islands. Even though these island groups are close—at one point near St. John they are only a mile or two apart—they are different in many ways. Some distinctions are bold; others are quite subtle.

The British islands are smaller, quiet and more reserved, less fond of nightlife, more informal, most active in watersports with little tennis and no golf, with fewer visitors half of whom are sailors.

The BVIs include approximately 60 islands, islets and cays. Scattered over 1300 square miles of ocean, their total combined area—about the size of Nantucket Island—would not quite equal the area covered by St. Croix.

Some of these islands are unexplored. Several are uninhabited. Two of the three largest islands, Tortola and Virgin Gorda have 90 per cent of the entire BVIs population, or about 9000 to 10,000 people. The third major island, Anegada, is inhabited by fewer than 300 people.

To enter the islands U.S. citizens need show only proof of nationality—a birth certificate, voter registration or passport will do, and a continuing or return ticket home. Citizens of other countries must have a current passport in addition to their ticket.

A great way to enter the BVIs is by boat from Charlotte Amalie. Two 90-passenger cruisers, the *Bomba Charger* and the *Native Son I* make the trip in about an hour.

Road Town, the territorial capital, is located in the south-central coast of Tortola, by one of the island's deep

continued

bays. Main street in Road Town is bordered by small shops, delicately colored in pastels. Chickens and goats wander freely through the light auto traffic.

The hills above Road Town climb steeply to the central ridge—where 1780-foot Mount Sage reigns as the highest elevation in the Virgin Islands. Hikers who make the climb are rewarded with a view of a rumpled green landscape stretching out towards the distant sister islands. Closer in, Ginger Island, Cooper Island, Salt Island, Dead Chest and Peter Island form a semicircle.

Peter Island is closest to what is probably the most famous dive site in the BVIs—the wreck of the *RMS Rhone.* This ship, which lies in 15 to 80 feet of water, was the underwater setting for the Columbia Pictures film, *The Deep.* Although their story was set in Bermuda, photographers Al Giddings and Stan Waterman brought Jacqueline Bisset, Lou Gossett, Nick Nolte and Robert Shaw here to enact a fictional tale of treasure salvage. Tortola dive operators George and Luana Marler participated in the filming, and in their book, *The Royal Mail Steamer Rhone,* they recount the salvage of the very real treasure which was aboard the *Rhone* when she sank in a hurricane October 29, 1867.

Shortly after the sinking, three brothers named Murphy set up shop on Salt Island for the purpose of salvaging goods from the numerous shipwrecks in the area. When the *Rhone* sank she was carrying mail, passengers and cargo under contract to the British government. Included in that cargo was approximately 60,000 pounds sterling in currency and gold bullion. At today's values, that's about $1,055,563 worth. The three Murphys, employing the crude diving dresses of the day, salvaged the specie and bullion. For their efforts they received $20,000, or about $72,000 in 1979 figures.

The *Rhone* is now protected by the BVIs government, and divers may take only photographs. But this is treasure enough. The 310-foot steamer is broken into two pieces, her bow section nearly intact. Divers swim in through the large opening where she split or through an open hatch and explore the nearly 150 feet of passageways, cabins and cargo holds. The foremast juts our perpendicular to the hull, its crow's nest intact. Schools of blackbar soldierfish live inside the bow, and cup corals surround great rends in the metal plates.

At the stern section, the rudder rises within 15 feet of the surface. Great steel hull structures rise from the midsection, rows of Corinthian columns, their capitals made of living sponge and coral instead of stone. A ring on the aft mast is crowned by a clump of brain coral and a huge sea fan. Schools of grunts, snappers, squirrel fish and horse-eye jacks endlessly weave through the wreckage, eagerly feeding on scraps offered by divers.

Yet in the face of such an adventure, remember that the *Rhone* is not the only dive near Tortola. The reefs here compare with any found in the Virgins.

At the Painted Walls, divers enter a long rock tunnel. With the white foam of the surge above, you swim the length of the corridor where every type of coral common to this area is on display, as if in a gallery. Luana Marler describes the walls as looking "...as though Picasso dabbled here, gracing the walls with frescoes in irridescent paint." Gorgonians and sea fans cling tenaciously to the vertical surfaces, the sponges—yellow, orange and lime green—protrude into the passage. The visibility is normally a minimum of 100 feet here, so Painted Walls is dived often, particularly when the seas kick up.

Although it is not accessible every day, Blond Rock offers the opportunity to dive with large pelagic fish. In the unprotected waters of the channel, the rock is usually surrounded by horse-eye jacks and amber jacks up to three feet in length. Lobster are found under the many coral ledges, and drops and crevices provide hours of pleasurable exploration. Nurse sharks and turtles are frequent visitors to the rock, and a wide range of tropicals are common.

From mid-February through April, humpback whales migrate through the Sir Francis Drake Channel, and it's not uncommon for divers to report hearing or seeing the pods as they move northward.

Renting a car in Road Town, take the Ridge Road and cruise over to Cane Garden Bay. The distillery there is one of several operating on the island and



GEORGE MARLER

the proprietor will gladly give you a tour and a free sample. At Fish Bay there is an old church, and at Anderson's a windmill—legacy of the early Dutch planters.

Another good way to see the real estate is from the air. Antilles Airboats flies into Tortola from the USVIs, and Air BVI and All Island Air Charters connect Tortola with Virgin Gorda.

Virgin Gorda's airstrip is on the south side of the island, on the flatlands. From here, a road leads northeast across a narrow isthmus to the mountainous northern end and Gun Creek. The road is torturous at best, and most of the taxis are four-wheel drive. As you wind up into the mountains, the sea below takes on various casts from the colorations of the bottom and the sky. Moving subtly from a weak baby blue inshore, the deep waters of the channel are a seemingly impossible shade of indigo.

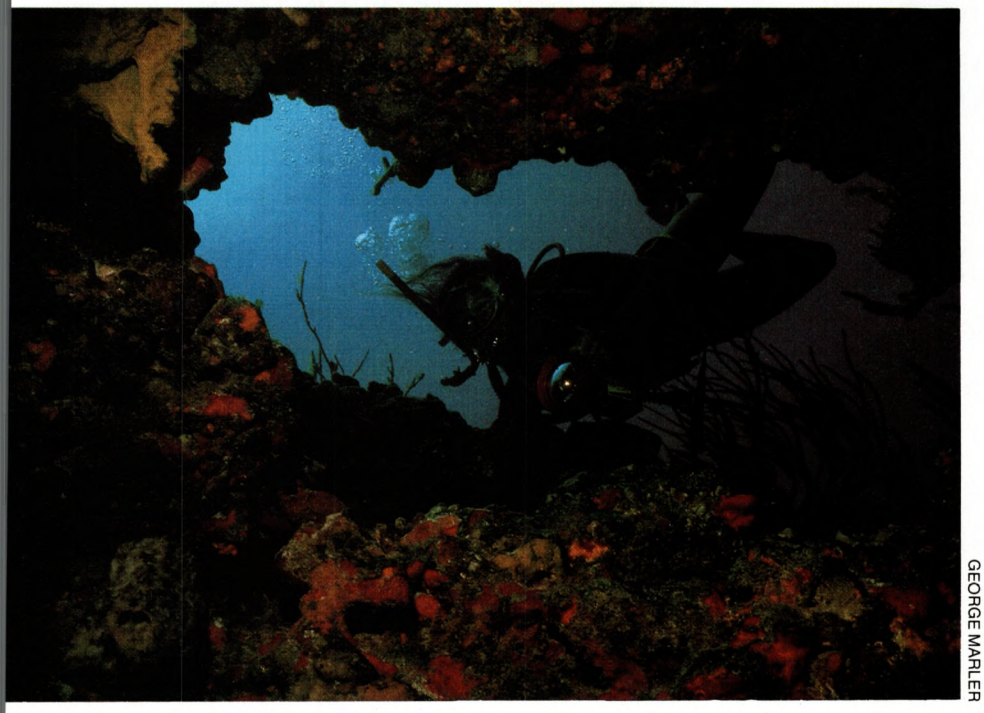
They hold the promise of clarity, warmth and adventure—and few diving visitors are disappointed.

The rocky shores of Virgin Gorda and its neighbor, Anegada, have collected their share of shipwrecks, and it is these wrecks and the rock formations that offer the best diving here.

At the southern end of Virgin Gorda, a boulder formation called the Baths has always intrigued vacationers. The huge granite rocks, piled one on the other look uninviting, but the crevices beneath allow hours of no-decompression exploration. Numerous passages wind between the boulders, leading to a shallow pool of water hemmed in by rock. The pools are outstanding for swimming, partying or just thinking;



DAVID DOUBILET



GEORGE MARLER



DAVID DOUBILET



DAVID DOUBILET

*Facing page: In addition to this cannon, the **Rhone** was carrying 60,000 pounds sterling in currency and bullion. The haul was salvaged almost immediately by three enterprising divers. Top: Blackbar soldierfish are not the most shy reef inhabitants, but they do tend to congregate in places where their small size is an advantage. Above: At Painted Walls, divers swim through a tunnel panelled with a rich covering of algae and sponges. Left: Hawskbill turtles are frequently-seen residents of the rocky ledges and coral outcroppings in the BVIs. Left, bottom: The BVIs seen in a morning fog.*

and as the afternoon sun streams in through small fissures, the interior glows with muted greens and grays.

Beneath the Baths lies a world of brilliant yellow soft coral, and tropical fish wander slowly through the gaps. While the average depth here is 20 feet, there are shafts that lead down to chambers 35 or 40 feet below the surface. The chambers are not particularly hazardous and are not closed in like a cave. In each there are short passages that lead to open water.

At least 65 wrecks have been located around Anegada alone, most of them by Jacki and Bert Kilbride. Bert has been diving these reefs since the early 1960s, and probably knows the area as well as any man could. Bert and Jacki live on Saba Rock, a small island that protrudes from the ocean just off the north end of Virgin Gorda. With his two sons, the Kilbrides escort divers to the best of the wrecks, Ginger Island and Anegada Reef.

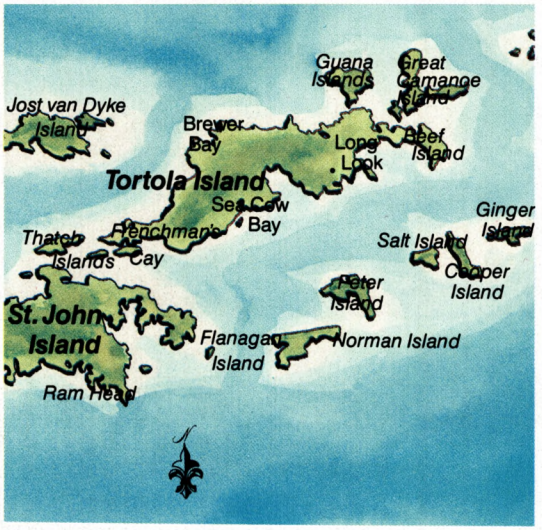
One of these wrecks, the *Paramatta*, was another ship of the Royal Mail Steam Packet Company, the same folks who owned the *Rhone*. She sank in 1859 on her maiden voyage, settling down in 35 feet of water. The ship is covered now with huge elkhorn corals and is visited by huge schools of pelagic fish —jacks and barracuda as well as the reef dwellers such as angels, squirrel fish and filefish. Huge jewfish are known to inhabit many of the wrecks here, and most are not particularly afraid of divers. They may be a little skittish, but a ban on spearfishing enforced by the Kilbrides has prevented the wholesale flight of the large fish from frequently-dived areas, common to some resorts.

On Virgin Gorda, all of the land above 1000 feet in elevation is a national park. In these highlands, hikers explore the ruins of a copper mine, first worked by the Spanish, then reopened by Cornish miners in 1840. Down at sea level, quiet coves and bays, secluded and very private, almost beg for someone to come picnic. And many do. As their days in the islands draw to a close, visitors are inexorably drawn to the seashore— wistfully contemplating the distant, ill-defined shores where their odyssey began—and planning to return.

continued



ILLUSTRATIONS: DON WARREN



TORTOLA

GENERAL

Location: 20 miles east of St. Thomas and 60 miles east of Puerto Rico
Size: 59 square miles
Topography: a hilly island with slopping beaches and rocky coastline
Climate: tropical with 47 inches of precipitation annually
Population: 9,000
Largest town: Road Town (population) 7,000
Languages: English
Ethnic composition: 80-90% black
Economy: 30% industrial, 70% tourism
Monetary unit: American dollar
Diving season: year-round
Tourist season: year-round

DIVING

Water temperature: winter 80° summer 83°F
Visibility: 90-100 feet
Depth of dives: 10-130 feet
Currents: 0-1 knot
Tidal fall: 18 inches
Types of diving: reef, wreck, night
Skill level: novice, intermediate, advanced
Dives per day: 4
Diving craft: good
Sights:
Fish: mottled angels, snapper, squirrel fish, sturgeon, jewfish
Coral: cup, black, elkhorn
Sponges: tube, vase
Other: Whales
Restrictions: No black coral, artifacts, live coral or shells may be taken.

DIVING SERVICES

Instruction available: resort course, open-water checkout, underwater photography
Equipment rental: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, BC with inflator, pressure gauge, depth gauge, compass, decompression meter, full wet suit, partial wet suit, knife, game bag, Nikonos
Equipment sales: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, BC with inflator, pressure gauge, depth gauge, compass, decompression meter, full wet suit, partial wet suit, knife, game bag, dive light, underwater strobe
Equipment repair: excellent
Camera repair: fair
Air: to 3000 psi
Guides: good

DIVERSIONS

Ground transportation: taxi, rental car
Shopping: fair and reasonable
Restaurants: excellent and reasonable, average dinner $10-15
Nightlife: fair
Other sports: sailing, swimming, fishing, shell collecting, six tennis courts
Don't Miss: primitive rain forest on Mt. Sage

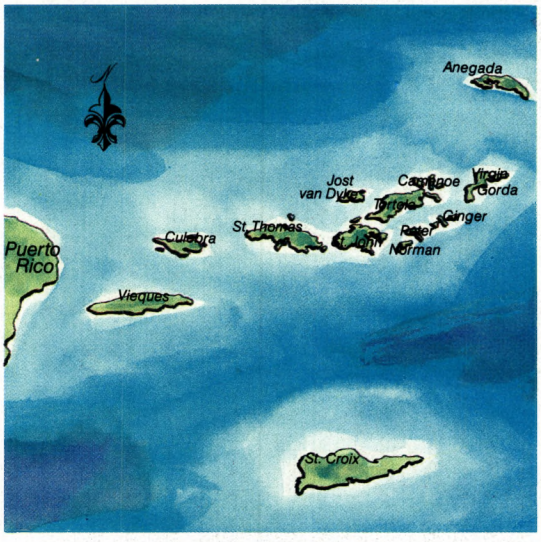
JUST IN CASE...

Hospitals: Peebles Hospital, Road Town, Tortola (809) 494-3498
Diving doctors: Government Medical Officer Donald MacKenzie, M.D. Peebles Hospital, Road Town (809) 494-2723
Recompression facilities: none
Police: (809) 494-3277
Marine Rescue: none
American Express: Representative: Cyril B. Romney, P.O. Box 437, Road Town, Tortola (809) 494-2872
U.S. Consulate: none

PLANNING

Diving tours: George & Luana Marler, P.O. Box 108, Road Town, Tortola (809) 494-2839
On your own: Take international carrier to San Juan, Puerto Rico; St. Thomas or St. Croix; then connect with All Island Air Taxi, St. Thomas, USVI (809) 494-1700 or Air BVI, Road Town, Tortola (809) 495-2356
Airports: Beef Island Airport
Marinas: Prospect Reef Resort, Box 104, Road Town, Tortola, (809) 494-3311; Treasure Isle Hotel, Box 68, Road Town, Tortola (809) 494-2501; Moorings-Mariner Inn, Box 139, Road Town, Tortola (809) 494-2332; Peter Island Yacht Club, Box 211, Road Town, Tortola (809) 494-2561; Marina Cay Hotel, Box 76, Road Town, Tortola (809) 494-2174
Accommodations: Prospect Reef Resort, Box 104, Road Town, Tortola (809) 494-3311; Long Bay Hotel, Box 433, Road Town, Tortola (809) 495-4252; Treasure Isle Hotel, Box 68, Road Town, Tortola (809) 494-2501; Moorings-Mariner Inn, Box 139, Road Town, Tortola (809) 494-2332; Sugar Mill Estate Hotel, Box 425, Road Town, Tortola (809) 495-4355; Village Cay Marina, Box 17, Road Town, Tortola (809) 494-2771; CSY Yacht Club, Box 157, Road Town, Tortola (809) 494-2741
Campgrounds: Brewers Bay Campground, P.O. Box 185, Road Town, Tortola (809) 494-3463
Customs and Immigration: proof of citizenship
Import restrictions: none
How much cash may you bring into the country? no limit
Export restrictions: none
How much native currency may you take out of the country? no limit
U.S. Customs re-entry restrictions–$300 worth of goods and currency may be brought back duty free

Where a notation "fair," "good," or "excellent" appears after an item, such as guides or diving craft, it refers to the *availability* not the quality of the services.





VIRGIN GORDA

GENERAL

Location: 4 miles northeast of Tortola
Size: 15 square miles
Topography: a hilly island with sloping beaches and rocky coastline
Climate: tropical with 45 inches of precipitation annually
Population: 1,200
Largest towns: Spanish Town (population) 100
Languages: English
Ethnic composition: 90% black, 10% other
Economy: 99% tourism
Monetary unit: American dollar
Diving season: year-round
Tourist season: year-round

DIVING

Water temperatures: winter 80°, summer 83°F
Visibility: 70-80 feet
Depth of dives: 10-130 feet
Currents: 0-2 knots
Tidal fall: 18 inches
Types of diving: reef, wreck, night
Skill level: novice, intermediate, advanced
Dives per day: 3
Diving craft: good
Sights:
- Fish: jewfish, yellowtail snapper, amberjack, barracuda, tropicals
- Coral: elkhorn, gorgonians
- Sponges: basket, tube

Restrictions: No black coral, artifacts, live coral or shells may be taken.

DIVING SERVICES

Instruction available: resort course, open-water certification
Equipment rental: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, BC with inflator, pressure gauge, depth gauge
Equipment sales: mask, fins, snorkel
Equipment repair: fair
Camera repair: none
Air: to 3000 psi
Guides: good

DIVERSIONS

Ground transportation: taxi, rental car, bicycle
Shopping: none
Restaurants: excellent and reasonable, average dinner $15
Nightlife: fair
Other sports: sailing, tennis, fishing, shell collecting
Don't Miss: The Baths, gigantic rock formations with ocean-fed grottoes.

JUST IN CASE...

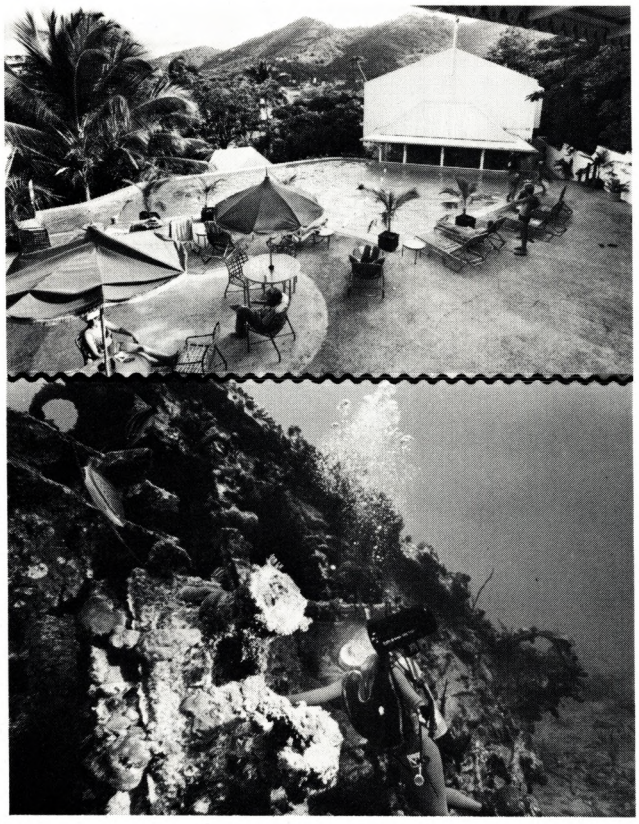
Hospitals: Government Clinic, Virgin Gorda (809) 495-5337
Diving doctors: Government Medical Officer Leon L. Bernstein, M.D. The Valley, Virgin Gorda (809) 495-5335
Recompression facilities: none
Police: (809) 495-5222
Marine Rescue: none
American Express: Representative–Cyril B. Romney, Box 437, Road Town, Tortola (809) 494-2872
U.S. Consulate: none

PLANNING

Diving tours: Bert & Jacki Kilbride, P.O. Box 40, Saba Rock, Virgin Gorda, BVI (809) 494-2746; Joe Giacinto, Dive BVI, Limited, Virgin Gorda Yacht Harbor, (809) 495-5513
Land tours: Virgin Gorda Tours Association, Virgin Gorda, (809) 495-5252
On your own: Airlines–Take International carrier to San Juan, Puerto Rico; St. Thomas or St. Croix; then connect with All Island Air Taxi, St. Thomas, U.S.V.I. (809) 494-1700 or Air B.V.I. Road Town, Tortola, (809) 495-2356
Airports: Virgin Gorda airstrip
Marinas: Bitter End Yacht Club, Box 46, Virgin Gorda (809) 494-2746; Biras Creek Hotel, Box 54, Virgin Gorda (809) 495-5455
Accommodations: Little Dix Bay Hotel, Box 70, Virgin Gorda (809) 495-5555; Biras Creek Hotel, Box 54, Virgin Gorda (809) 495-5455; Bitter End Yacht Club, Box 46, Virgin Gorda (809) 494-2746
Customs and Immigration: proof of citizenship
Import restrictions: none
How much cash may you bring into the country? no limit
Export restrictions: none
How much native currency may you take out of the country? no limit
U.S. Customs re-entry restrictions–$300 worth of currency and goods may be brought back duty free

Where a notation "fair," "good," or "excellent" appears after an item, such as guides or diving craft, it refers to the *availability* not the quality of the services.

AQUATIC CENTRES/TREASURE ISLE HOTEL— TORTOLA, BRITISH VIRGIN ISLANDS



P.O. Box 108SD, RoadTown, Tortola, BVI. (809) 494-2858.

RESERVATIONS: Treasure Isle Hotel, 501 Madison Ave., New York, N.Y. 10022. Toll free (800) 221-4588 (except NY (212) 355-6605).

LOCATION—Hotel and dive store situated in lush garden setting at water's edge on South side of island. One mile from Road Town, capital of BVI, 8 miles from Beef Island Airport.

TRANSPORTATION—Air: Air Florida, American, Eastern from Miami to St. Thomas or St. Croix. All-Island Air, Air BVI or Dorado Wings to Tortola. Ground: taxi from airport $4/2 people, limited rental cars.

ACCOMMODATIONS—40 spacious rooms, each air conditioned with view of the harbor and Sir Francis Drake Channel. Fresh water pool, restaurant, bar, tennis and squash courts. Private beach club 20 min. by boat. All sport facilities include dive store, yacht marina in front of hotel with bareboat, day sail and sunfish rentals. Rates: single $30, double $36, summer; single $52, double $62, winter. Travelers checks accepted.

DIVING AVAILABLE—

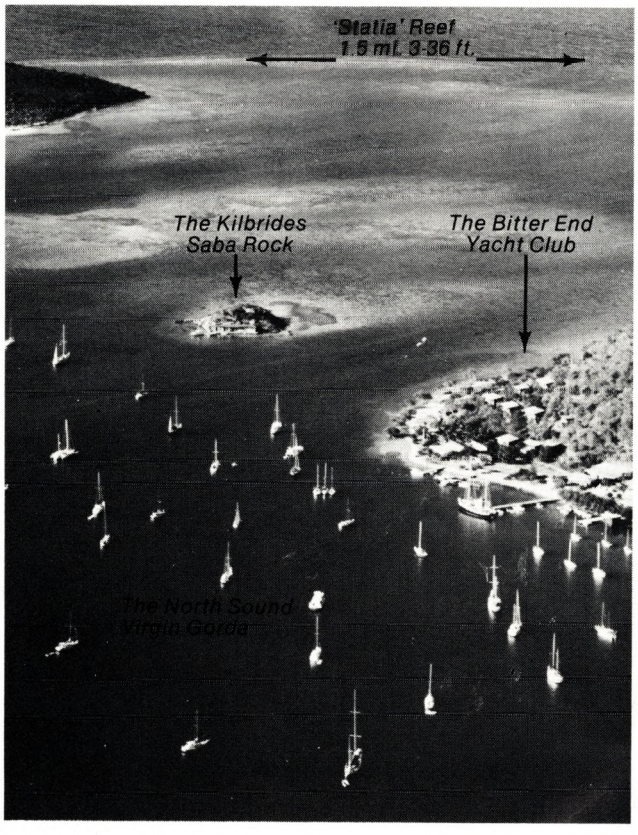
Shallow reef (5'-33') **yes**	Walls **no**	Drift dives **no**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **yes**	Beach dives **no**

DIVING EQUIPMENT—3 Mako compressors, 3000 PSI. 105-72 tanks. Specially built dive boat, *TEJAS*, makes daily trips to THE RHONE wreck. Full service dive store has complete lines of equipment for sale/rent. Repair facilities for major brands. Nikonos cameras for sale/rent, U/W photo equipment available.

DIVING SERVICES—All major certifications. 1 instructor/1 divemaster. Resort course, full certification, wreck diving and U/W photo courses available with personalized instruction by George Marler. Cost for one dive $25, two dives $40, three dives $60. Multiple dive rates, 5 dives $100, 10 dives $175, 15 dives $262.50, 18 dives $315, rates per person.

DIVING PACKAGES—8 days/7 nights $576 for 10 dives, $686 for 15 dives, $705 for 18 dives per person double occupancy. Includes accommodations, transfers to and from airport, 3 meals/day, diving, tank, bac pac and weight belt/lead.

BITTER END YACHT CLUB/ KILBRIDE'S UNDERWATER TOURS— VIRGIN GORDA, BRITISH VIRGIN ISLANDS



P.O. Box 46, Virgin Gorda, British Virgin Islands. Phone: 42746.

RESERVATIONS: The Bitter End Yacht Club, 875 N. Michigan Avenue, Chicago, Illinois 60611. Phone: (312) 944-5855.

LOCATION—Yacht Club on the beachfront overlooking North Sound. Kilbride's Underwater Tours based 500' feet offshore on Saba Rock.

TRANSPORTATION—Air: Air Florida, American, Eastern from Miami to San Juan or St. Thomas, flights from either on Dorado Wings, Air BVI or All-Island Air to Virgin Gorda. Charters: Several airlines from San Juan. Ground: Taxi and club launch included for three nights or more.

ACCOMMODATIONS—13 rooms on beach and hillside with twin beds, private baths with freshwater showers and private decks. Restaurant and bar on premises. Rates include unlimited sailing and use of Club's fleet of Lasers, Sunfish, Rhodes 19's, Windsurfers, outboard-powered skiffs, and on-the-beach sailing instruction. Rates: single $75, double $95, triple $130, summer. Family of 4 (2 adults and 2 children under 16) $165 (Full American Plan). No tipping, $6 per diem charge per person, 5% BVI Government tax. Amex credit cards accepted.

DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **no**	Drift dives **yes**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **yes**	Beach dives **yes**

DIVING EQUIPMENT—2 Mako compressors, 3000 PSI. 100 tanks. 2 boats include custom 30' and 42' with diver capacity of 35. Tank/bac pac and weight belt/lead included.

DIVING SERVICES—PADI affiliation. Accept all major certifications. 5 instructor/divemasters. Resort course with 1 dive $50, full certifications, 1 week with 10 dives $300, advanced training $50. Cost/half-day diving $40, includes 2 tanks, 3 tank dives on request, night dive $50.

DIVING PACKAGES—5 days/4 nights for $298 per person double occupancy. Includes accommodations, ground transfers, 3 meals daily including dive lunches, minimum of 6 dives and tank/bac pac, weight belt/lead. Rates based on Summer May 1-November 10.

MOUNTAIN TOP RESORT/KILBRIDE'S UNDERWATER TOURS—EUSTATIA ISLAND, BRITISH VIRGIN ISLANDS

Eustatia Island, British Virgin Islands. Phone: (617) 922-128

RESERVATIONS: Mountain Top Resort, c/o Robert Price, One Pine Road, Beverly, Massachusetts 01915. Phone: (617) 922-1289.

LOCATION—Hilly 35-acre island, resort rests on saddle of hill 80' above North Sound, 500 yds. from Saba Rock. 30 minutes from Tortola, BVI.

TRANSPORTATION—Air: Air Florida, American, Eastern from Miami to San Juan or St. Thomas, regularly scheduled flights on Dorado Wings, Air BVI or All-Island Air to Virgin Gorda. Charter: Several airlines from San Juan. Ground: Potter Taxi from airport to Gun Greek $10, water taxi to island 10-minute boat ride.

ACCOMMODATIONS—6 rooms with twin and double beds. Resort is Spanish styled house with 3 private beaches, dock, beach bar-b-que, and restaurant/bar. Resort is demonstration of total ecological living with wind generator for power, rain water stored in cool cisterns, hot water supplied by solar collectors.Rates: May 14-Dec. 14, single $50 (Modified American Plan), double $35 (MAP); December 15-May 13, single $72 (MAP), double $45 (MAP).

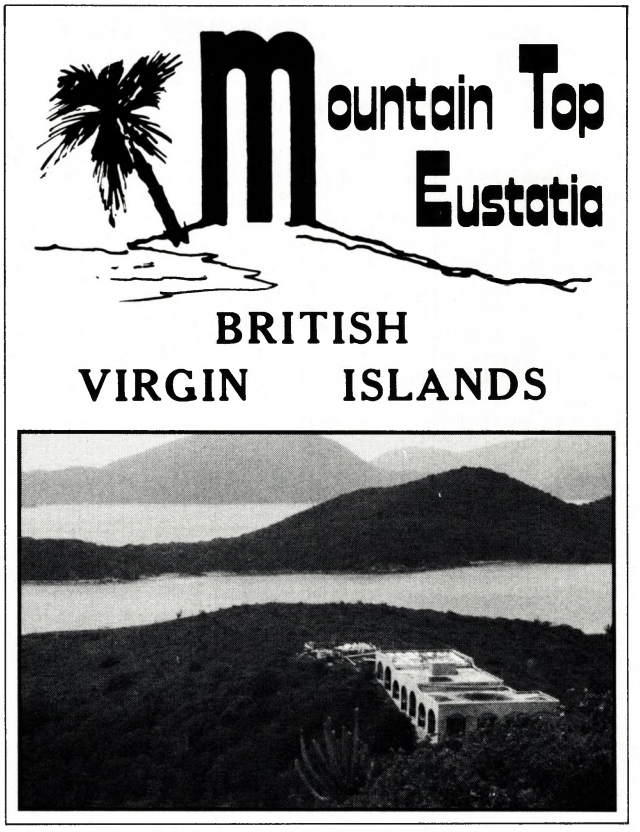
DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **no**	Drift dives **yes**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **yes**	Beach dives **yes**

DIVING EQUIPMENT—2 Mako compressors, 3000 PSI. 100-72 cu/ft tanks. 2 boats include custom 30' and 42' with diver capacity of 35. Tank/bac pac and weight belt/lead included with each dive.

DIVING SERVICES—PADI affiliation. Accept all major certifications. 5 instructor/divemasters. Resort course with one dive $50, full cert., one week with 10 dives $300, advanced $50. Cost/half day diving $40 includes 2 tanks, 3 tank dives on request, night dive $50.

DIVING PACKAGES—8 days/7 nights $400 per person (groups of 6-8). Includes accommodations, 5-2 tank boat dives with Kilbirde's Underwater Tours, tank, bac pac, wt. belt/lead, and MAP. Rates based on Summer May 14-December 14.



ABOVE AND BELOW, INC./WEST END DIVING—ST. CROIX, U.S. VIRGIN ISLANDS

12 Strand Street, Frederiksted, St. Croix, USVI 00840. (809) 772-3701.

RESERVATIONS: Above and Below, Inc., c/o Ed Wendt, 12 Strand St., Frederiksted, St. Croix, USVI 00840. (809) 772-3701.

LOCATION—Store is situated downtown Frederiksted on west end shore of the island, within walking distance of Frederiksted Pier, known for its sea horses. Twenty minutes from airport.

TRANSPORTATION—Air: Air Florida, American, Eastern, from Miami and other major cities. Prinair from San Juan. Charter: Several airlines from San Juan. Ground: Taxi from airport $5-$10, major car rentals at airport or downtown, bus from airport $.50 per person.

ACCOMMODATIONS—Spratt Hall Plantation, King Frederick Hotel, Cottages by the Sea, Smithfield Guest House, Royal Scotia, The Frederiksted, Villa Morales and Sunset Cottages. Several fine restaurants in Frederiksted. All within walking distance of downtown. Rates: range from luxury to economy. Contact dive store for more information and bookings. No credit cards accepted.

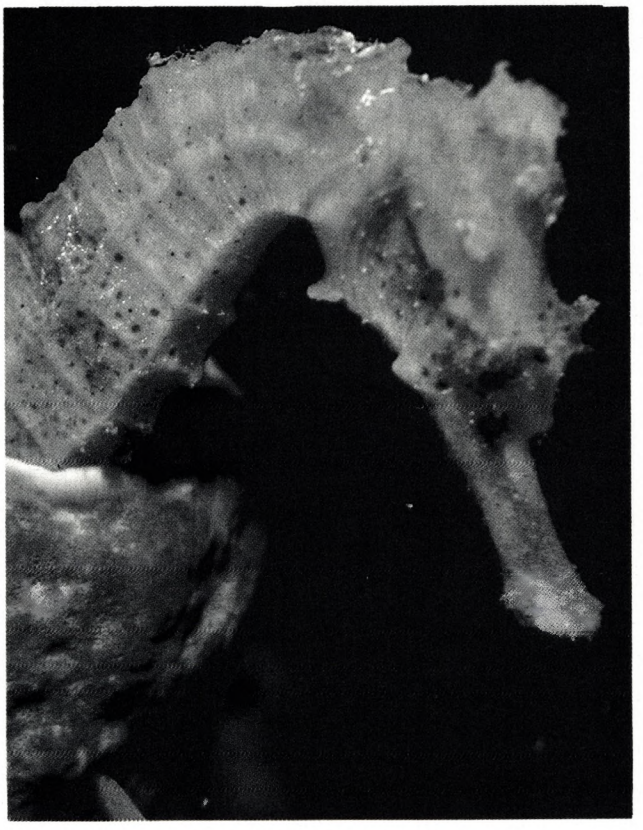
DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **yes**	Drift dives **no**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **no**	Beach dives **yes**

DIVING EQUIPMENT—Mako compressor, 5000 PSI. Thirty-six tanks. Thirty 72 cu/ft, six 80 cu/ft. 21' Mako dive boat, with a total diver capacity of five. Full service retail sales and complete line of rental equipment. Underwater photography and film in stock with forty-eight hour processing available.

DIVING SERVICES—PADI, NAUI affiliation. One instructor and two divemasters. Resort course $35, full certification $200, guided tours $25. Half-day diving $25 includes one tank; full day diving $50 includes two tanks; 5 dives $90, night dive $30. All equipment included in rate. Group rates are available.

DIVING PACKAGES—Eight days/seven nights for $249-269 per person, based on double occupancy. Includes accommodations, two meals per day, two boat dives per day, airport and dive transportation.



ANCHOR INN HOTEL/PRESSURE LTD.— ST. CROIX, U.S. VIRGIN ISLANDS

58-A King's Street, Christiansted, St. Croix, USVI 00820. (809) 773-4837.

RESERVATIONS: Pressure Ltd., c/o Brian Friedman/President, P.O. Box 3612N, Christiansted, St. Croix, USVI 00820. (809) 773-4837. Or Anchor Inn Hotel, 58-A King's Street, Christiansted, St. Croix, USVI 00820. (809) 773-4000.

LOCATION—Hotel is conveniently located in the heart of downtown Christiansted and the National Historic Site. Access to wharf and main streets. Dive facility is unique floating 46' x 14' custom dive shop situated dockside on King's Wharf adjacent to hotel. Twenty minutes from Alexander Hamilton Airport.

TRANSPORTATION—Air: Air Florida, American and Eastern with direct flights from Miami. Air Florida has connections from major cities in Florida as well as Washington, D.C., Philadelphia and New York, Prinair from San Juan. Charters: Several airlines from San Juan. Ground: Taxi from airport is $3/two people, major car rentals at airport.

ACCOMMODATIONS—30 rooms in hotel all have double or twin beds. Each room has TV, phone, private bath with freshwater shower, balcony with louvered shutters and individually controlled A/C. Some have refrigerators. All suites have double beds. Freshwater swimming pool and sundeck are directly on the water. Don's Restaurant serves meals year round, overlooking historic Christiansted harbor. Entertainment in bar of restaurant with weekly U/W slide show. Hotel and dive store are within walking distance of many historical sites, other fine dining and entertainment. Rates: single $28-34 summer, $38-46 winter (European Plan), double $37-47 summer, $46-56 winter (European Plan), triple $40-50 summer, $59-69 winter (European Plan). 10% service charge added, no taxes. Major credit cards accepted.

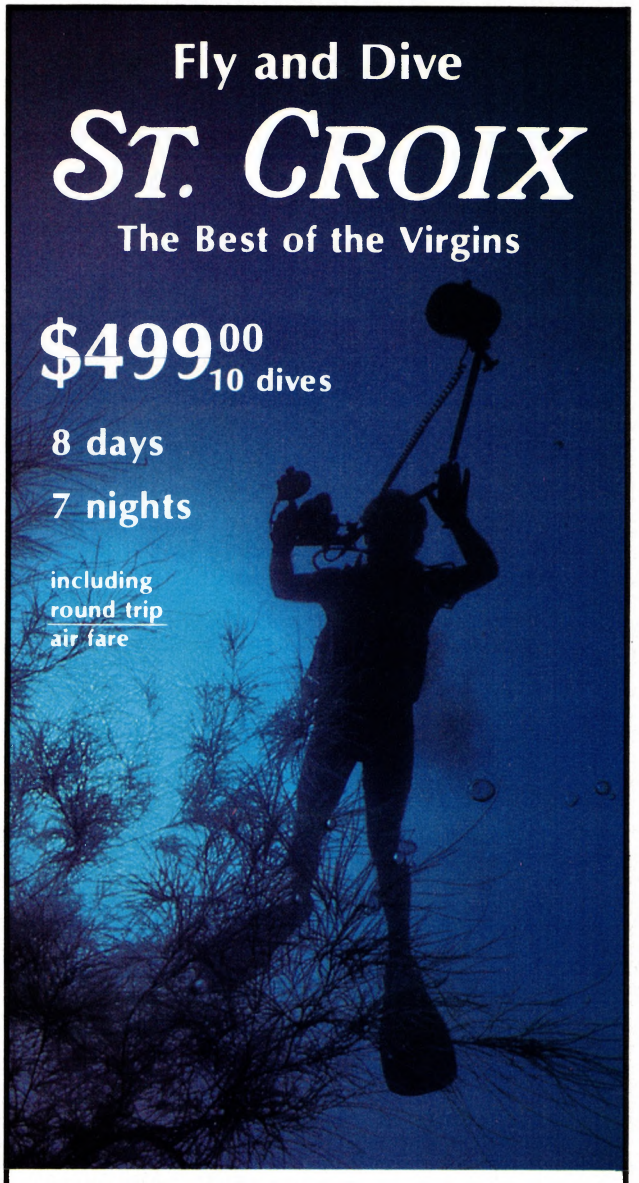
DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **yes**	Drift dives **no**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **yes**	Beach dives **yes**

DIVING EQUIPMENT—2 Mako compressors, 3200 PSI. 70 tanks, each 72 cu/ft. 3 dive boats include two 22', 6 passenger Aquasports with 175 hp. New boat, *CRUZAN DIVER*, is 46' Hilbert design, trawler type, wood dive boat with 20' of flush sterndeck. Large dive platform, USCG inspected for 35 passengers, though only 20 divers are carried at a time for comfort and room. Full electronics, excellent stereo system, large sun cover and freshwater rinse off shower. Diver capacity of 47. Full retail boat store is equipped with all major brands. Full rental/repair shop with 20 sets of regulators, buoyancy compensators, bacpacs and snorkel equipment for 50 divers. Rental rates include tank/bac pac $6/day, mask/snorkel $2/day, weight belt/lead $2/day, regulator $4/day, fins $2/day, U/W light $5/day, electronic flash $10/day, U/W super eight camera $10/day and Nikonos $20/day. 24-hour film processing in St. Croix $5/roll, film on stock at both store and downtown.

DIVING SERVICES—PADI and NAUI affiliation. 3 instructor/divemasters who are CPR/first aid trained. Resort course $35 individual, $60 couple, full cert. $225 for week of instruction, includes all necessary equipment. ½ day diving (one dive) $25, full day diving (two dives) $40, three dives $60 includes lunch, sodas and rum punch, night dive $30. Tank, bac pac, wt. belt/lead included in dive rate. Dives are preplanned for maximum time underwater, complete briefing before dive to determine individual skill and desires. Dive sites are short boat ride from dive store/dock.

DIVING PACKAGES—8 days/7 nights for $499 per person double occupancy, summer. Includes 10 dives, round trip airfare from anywhere on Air Florida's route (including Philadelphia and Washington, D.C.). Hotel accommodations at Anchor Inn, 5 two-tank guided boat dives, tank, bac pac, weight belt/lead included, daily breakfast, Pressure Limited T-shirt, weekly U/W slide show and rum punch party. 5 days/4 nights for $365 per person double occupancy, summer. Includes same amenities as 8 day packages except 3 two-tank guided boat dives instead of 5. Options: exchange one day of diving (two tanks) for a night dive (one tank) or exchange one day of diving for a full day sailing excursion to Buck Island National Park. Non-diver packages, 8 days/7 nights $374 per person double occupancy, summer; $390 per person double occupancy, winter. 5 days/4 nights $285 per person double occupancy, summer; $300 per person double occupancy, winter. Includes airfare, breakfast, ground transfer, hotel accommodations, full day sailing/snorkeling excursion to Buck Island National Park. A hundred dollar deposit is required per person at time of reservations, balance of payments are due thirty days prior to departure. Cancellations are accepted up to thirty days prior to departure with full refund, less than 30 days are subject to cancellation fee of 10% of package price. For more information, see your travel agent, IT Number QHPL1, or write to above reservations address.



* ROUND TRIP AIR FARE from anywhere on AIR FLORIDA'S route (including Philadelphia, New York and Washington D.C.)
* HOTEL ACCOMMODATIONS at the ANCHOR INN
* 5-TWO TANK GUIDED BOAT DIVES with PRESSURE LTD. (8 days/7 nights package)
* 3-TWO TANK GUIDED BOAT DIVES (5 days/4 nights package)
* PACKAGE INCLUDES tanks, bac pacs, and weight belts with lead.
* DAILY BREAKFAST at DONN'S ANCHOR INN RESTAURANT (gratuities not included)
* WELCOME DRINK
* GROUND TRANSPORTATION to and from airport
* PRESSURE LTD. T-SHIRT
* WEEKLY SLIDE SHOW/ RUM PUNCH PARTY

anchor inn OF ST. CROIX

PRESSURE LTD.

air florida All jet All the time

Pressure Ltd., P.O. Box 3612N, Christiansted, St. Croix, U.S.V.I. 00820, (809) 77-D-I-V-E-R

AQUA ACTION/SECRET HARBOUR HOTEL— ST. THOMAS, U.S. VIRGIN ISLANDS

St. Thomas, USVI 00801. Phone: (809) 775-1010.

RESERVATIONS: Resort Representation Service, Time-Life Building, Suite 3717, 1271 Avenue of the Americas, New York, New York 10020. Phone toll free: (800) 223-0480 (except NY (212) 586-8449).

LOCATION—Secluded resort hidden among sun dappled palms on East end of island. Directly on beach, twenty five minutes from airport.

TRANSPORTATION—Air: Air Florida, American, Delta and Eastern from Miami, Prinair from San Juan. Charter: several airlines available from San Juan. Ground: taxi from airport $6.50 for two people, major car rentals available at airport.

ACCOMMODATIONS—Sixty spacious suites with air conditioning, tiled tub-bath, room phone, fully equipped kitchen and private patio or gallery. All suites face sunset and the ocean. Full water sports center located on beach, unlimited tennis, Beach Bar, Gazebo, Restaurant serves 3 meals/day 7 days/week. Rates: Apartment $35-80 (EP), 1 bedroom suite $50-100 (EP), 2 bedroom suite $100-175 (EP). Add $36 for MAP, $1/day for maid gratuity. No credit cards accepted.

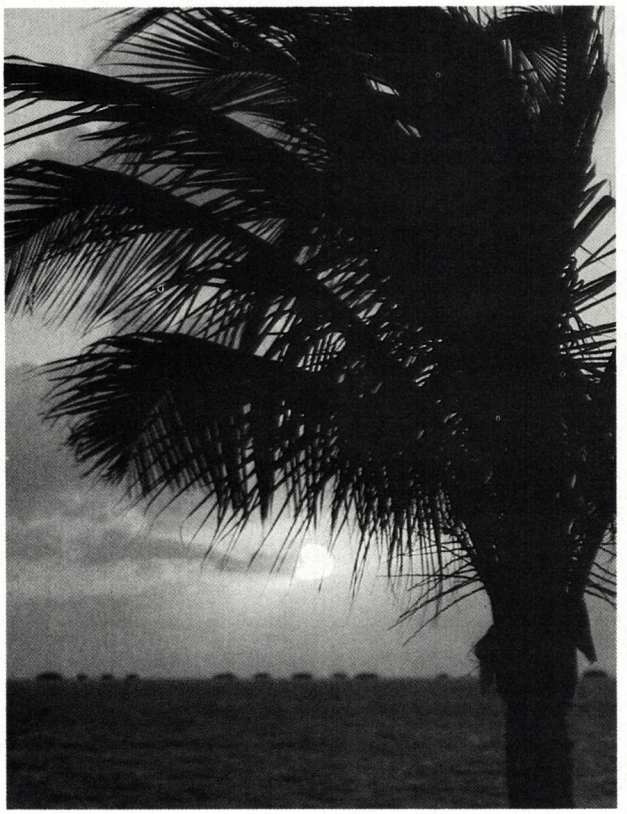
DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **no**	Drift dives **no**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **yes**	Beach dives **yes**

DIVING EQUIPMENT—Bauer and Ingersoll-Rand compressors, 3000 PSI. 75 tanks. Three dive boats include new 38' Mathews with 18 diver capacity, 4 Sunfish sailboats for rent. Limited retail sales. Complete equipment included in dive rate. Rental equipment available.

DIVING SERVICES—NASDS, PADI, NAUI affiliation with six instructor/divemasters available. Resort course $30, full certification $175, snorkel lesson $15. Cost for boat dive $35, night dive $35 includes gear and light.

DIVING PACKAGES—7 days/6 nights for $500 per person. Includes air conditioned accommodations, choice of 2 beachfront hotels, 2 meals/day, welcome drink and slide show, 8 dives, tanks, bac pac, weights, boats, guide, RHONE wreck, taxi transfers from/to airport, and free time for extras. Call or write for reservations.



BOLONGO BAY BEACH & TENNIS CLUB/ OCEAN ADVENTURES— ST. THOMAS, U.S. VIRGIN ISLANDS

P.O. Box 7337, St. Thomas, USVI 00801. (809) 775-1800

RESERVATIONS: Bolongo Bay Beach & Tennis Club c/o Dick Doumeng, P.O. Box 7337, St. Thomas, USVI 00801. (809) 775-1800 or toll free (800) 223-5695 (except NY (212) 730-8100).

LOCATION—Club is situated on 10 acres of property on southeast side of island on beach. 3 miles from downtown and 10 minutes from airport.

TRANSPORTATION—Air: Air Florida, American, Delta, Eastern from Miami. Charters: several airlines available from San Juan. Ground: taxi from airport $4.50, major car rentals at airport.

ACCOMMODATIONS—Thirty-seven room deluxe resort with 800' of private beach. Rooms are all air conditioned with private bath, freshwater shower, some with kitchen facilities, balcony and radios. Resort has four tennis courts, pier, dive store and freshwater pool. Restaurant, lounge/bar with nightly entertainment. Rates: single $48, double $52, summer, $84 winter. Major credit cards accepted.

DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **no**	Drift dives **no**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **yes**	Beach dives **yes**

DIVING EQUIPMENT—2 Worthington compressors, 3000 PSI. 80-72 cu. ft. tanks. 2 boats include new Lindsey 43' and Dusky 32' with total diver capacity of 38. Full service retail sales and complete line of rental gear. Tank, bac pac, weight belt, regulator, BC, mask/snorkel and fins included in dive rate. U/W camera $25/day.

DIVING SERVICES—NAUI, PADI affiliation. 4 instructors and 2 divemasters with CPR training. Resort course $25, full certification $175, advanced training $75-300, U/W photo, bottle hunting and specialty courses available. Cost/half day diving $25 for 2 tanks, full day diving $50 for 3 tanks, night dive $35 beach, $40 boat.

DIVING PACKAGES—Special package price available through St. Thomas Diving Club. Includes accommodations, 18 dives, airport transfers, equipment (based on double occupancy).

bolongo bay
BEACH AND TENNIS CLUB





Wreck of the Rhone 1867 The site for the filming of the movie "The Deep" Photo Armando Jenik

CARIBBEAN SEA ADVENTURES/BUCCANEER HOTEL/JOCKEY CLUB/KING CHRISTIAN HOTEL—ST. CROIX, U.S. VIRGIN ISLANDS

P.O. Box 3015, Christiansted, St. Croix, USVI 00820. (809) 773-5922.

RESERVATIONS: Caribbean Sea Adventures, c/o Larry Angus, P.O. Box 3015, Christiansted, St. Croix, USVI 00820. (809) 773-5922.

LOCATION—Dive store: situated in heart of downtown Christiansted, directly on harbor next to King Christian Hotel. King Christian Hotel: within walking distance of historical sites and downtown, 10 minutes from airport. Buccaneer Hotel: resort is on the water two miles from Christiansted, 30 minutes from airport. Jockey Club: located on mile long island in Christiansted Harbour, 100 yards offshore from downtown reached by ferry, 10 minutes from airport.

TRANSPORTATION—Air: Air Florida, American, Eastern, from Miami and other major cities to St. Croix. Prinair from San Juan. Charter: Several airlines available from San Juan. Ground: Taxi from airport $2.50 per person to dive store location; Hertz and other car rentals available at airport and downtown.

ACCOMMODATIONS—Buccaneer: 155 rooms include 12 suites with two rooms. Hotel is on 200 acres of land with 18-hole golf course, eight tennis courts, three beaches, watersports center, freshwater pool, two boutiques, two restaurants. Rooms have air conditioning, private bath, terrace and phone. Rates: double $35-75, double double $44-85, suites $110, summer. Jockey Club: fifty-five rooms include five suites with living rooms. Rooms are air conditioned with phones and balconies. Hotel is on its own island offshore Christiansted, with five tennis courts and resident pro, watersports center on premises, freshwater pool, white sand beaches, restaurants, beach bar, lounge with nightly entertainment. Rates: single $45 summer, $85-90 winter, double $48 summer, $90-95 winter, suites $65-100. Rates are European Plan. 10% service charge in summer. King Christian: Thirty-eight rooms which can be booked either single or double. All rooms air conditioned with private balconies, telephone and one apartment has kitchen facilities. Hotel has restaurant, bar with entertainment, freshwater pool, watersports center, duty free shops and dine-around plan which includes breakfast and dinner at guest's choice of nearby restaurants. Rates: single $28-32, double $38-42, summer (European Plan). Major credit cards accepted at all locations.

DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **yes**	Drift dives **no**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **no**	Beach dives **yes**

DIVING EQUIPMENT—Worthington compressor, 5000 PSI with storage tank capacity of 35,000 cu/ft. Seventy-five 72 cu/ft tanks. Five dive boats include 40' custom, 27' Lindsey Offshore, 20' Robalo, 20' Bristol, 21' Grady White. 40' *DELIVERANCE* is USCG certified, freshwater shower, large dive platform for easy entry and exit, tank racks and camera storage with diver capacity of twenty-three. Full service retail store with complete line of equipment for sale. Rental rates: tank/bac pac $6.50/day, mask/snorkel $2/day, weight belt/lead $2/day, regulator with gauge $5/day, fins $1.50/day, light $5/day, Nikonos $15/day and strobe $10/day. Film on stock, twenty-four hour processing $6/roll.

DIVING SERVICES—SSI, PADI, NAUI affiliation. Five instructors and six divemasters. Resort course $35, full certification $200, basic underwater photography $150, advanced courses available upon request. Cost for half-day diving $40 for two dives, cost for full day diving $60 for three dives, night dives $30, multiple dives include ten dives $180, six dives $110. All basic equipment included in dive rate but suggest bringing personal equipment due to comfort and familiarity. All dives are boat dives, Captains licensed and certified by USCG.

DIVING PACKAGES—Buccaneer: 7 days/6 nights $405-505 per person double occupancy. 5 days/4 nights $270-390 per person double occupancy. Jockey Club: 7 days/6 nights $405 per person double occupancy. Buccaneer and Jockey Club packages include accommodations, hotel facilities, 5 two tank dives on 7 day plan, 3 two tank dives on 5 day plan, all necessary diving equipment, ½ price on U/W photo rental, weekly trip to wreck of THE RHONE, optional night dive and day sail to Buck Island. King Christian: 8 days/7 nights $377.50 per person based on double occupancy. 5 days/4 nights $225.00 per person based on double occupancy. Non diver allowance given. Includes accommodations, round trip transfers between airport and hotel, welcome drink, introductory scuba lesson, complimentary use of U/W camera one day, walking tour of Christiansted, beach privilege, complimentary chaise lounges at pool, 5 two tank dives on 7 night plan, 3 two tank dives on 4 night plan and either European Plan or Modified American Plan ($16 pppd). Children under 12 free in parents' room. For more information write for free brochures at reservations address.



JOE VOGEL DIVING COMPANY— ST. THOMAS, U.S.VIRGIN ISLANDS

Box 7322, St. Thomas, U.S.V.I. 00801. Phone: (809) 774-2321.

RESERVATIONS: Joe Vogel Diving Company, Post Office Box 7322, Charlotte Amalie, St. Thomas, U.S.V.I. Phone: (809) 774-2321.

LOCATION—Two store locations: Downtown store faces harbor in center of Charlotte Amalie at Sebastian's Restaurant. Ten minutes from airport. Marina store is at Compass Point Marina. Five minutes from Red Hook and thirty minutes from aiport.

TRANSPORTATION—Air: Air Florida, American, Delta and Eastern from Miami and other major cities, Prinair from San Juan. Charter: Several airlines available from San Juan. Ground: Courtesy pick up can be arranged from shop downtown. Taxi from airport $2.50 for two people, $4.50 for two people to Compass Point, major car rentals available at airport.

ACCOMMODATIONS—Abundant variety of hotels and guest houses in downtown Charlotte Amalie or at beach. Room rates range from first class full service to economy. Variety of prices and selection. Contact downtown store for reservations. Major credit cards accepted at most locations.

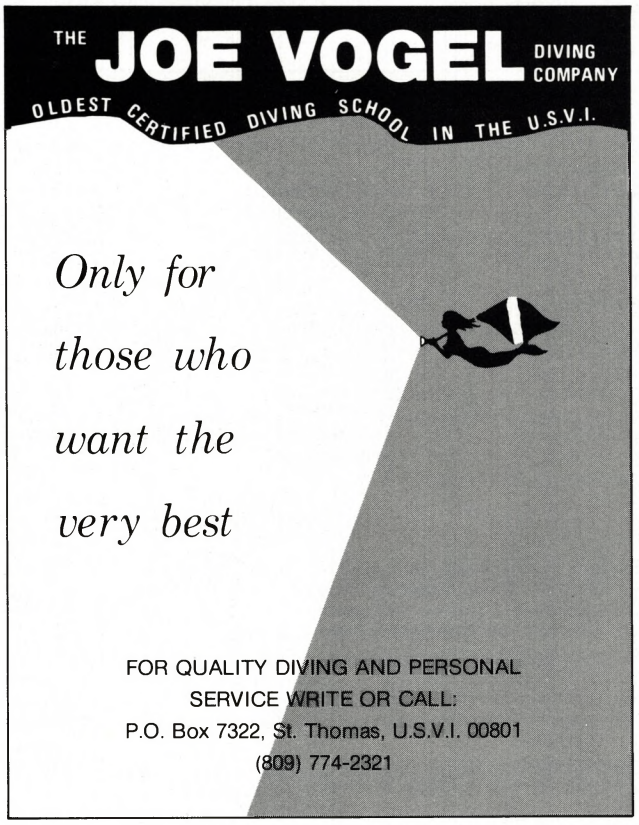
DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **no**	Drift dives **no**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **no**	Beach dives **yes**

DIVING EQUIPMENT—Worthington compressor, 3000 PSI. Forty 72 cu/ft tanks. Full service dive store has complete retail sales and rental equipment. Film and overnight processing available.

DIVING SERVICES—NAUI affiliation. One instructor and divemaster. Resort course $30, full certification (seasonal only) $175. Cost for full day diving $14-20 for 1-2 dives, $42-58 for 3 dives, night dive $19-25. Cost reduced for divers with own gear. Tank, bac pac, weight belt and lead included in price of dive.

DIVING PACKAGES—Six dives, all equipment provided $113. Six dives, tank/bac pac, weight belt provided $90. Package dives are beach dives. Other dive sites available.



"MISTY LAW" TRIMARAN CRUISES— VIRGIN ISLANDS

Sheraton Marina, St. Thomas, USVI 00801. Phone: (809) 774-5630.

RESERVATIONS: Trimaran MISTY LAW, Homeport, St. Thomas, USVI 00801. (809) 774-8282, ask for MISTY LAW. Or Ocean Enterprises, P.O. Box 3375, Stateline, Nevada 89449. Phone: (702) 588-3571.

LOCATION—Trimaran is docked either at Village Cay Marina, Road-Town, Tortola, BVI, or Sheraton Marina, St. Thomas, USVI. Pickup arranged anywhere in Virgin Islands. Marinas located within walking distance of both towns, 20 minutes from either airport.

TRANSPORTATON—Air: Air Florida, American, Eastern from Miami to St. Thomas or San Juan. Regularly scheduled flights from either on Dorado Wings, Air BVI or All-Island Air to Tortola. Charters: several airlines from San Juan. Ground: Taxi from airport $5.

ACCOMMODATIONS—MISTY LAW is 56' luxury trimaran with 4 staterooms, 4 private heads with freshwater hot/cold showers, all electric galley, dining table on deck, table in salon area, free bar, library and marine radio. Waterskiing, fishing and windsurfing included in rates. Rates: $80 per person per day, based on group of 8, winter, $65 per person per day, based on group of 8, summer. No credit cards.

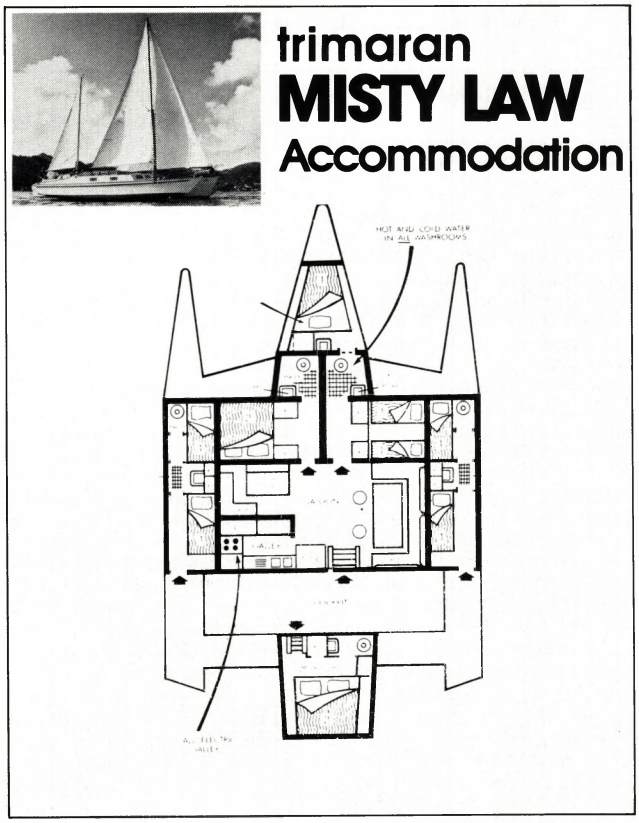
DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **no**	Drift dives **yes**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **no**
Deep reef (66'-99') **yes**	Caverns **yes**	Beach dives **no**

DIVING EQUIPMENT—2 Bauer compressors, 3000 PSI. 12 tanks, 4-72 cu/ft 8-80 cu/ft. 2 inflatable boats include 17' with 75 hp and 12' with 6 hp for total diver capacity of 14. Tank, bac pac, wt. belt/lead, BC's, regulator, mask/snorkel and fins included in rate. No photo gear.

DIVING SERVICES—PADI affiliation. 1 instructor/1 divemaster. Resort course, snorkel lessons and dives included in rate. Full certification $75, advanced course available.

DIVING PACKAGES—13 days/12 nights for $780 per person based on groups of 8. Includes accommodations, 3 meals/day, gear, 3 dives/day, no night dives. $300 deposit required with reservation, fully refundable 12 weeks before departure. Balance due 4 weeks before departure.



NAMU DIVE/SAIL CRUISES— U.S. VIRGIN ISLANDS

Homeport, St. Thomas, USVI 00801. Phone: (800) 225-2520.

RESERVATIONS: Caribbean Yacht Charters, c/o Frank Holt, P.O. Box 583, Marblehead, Massachusetts 01945. Phone toll free: (800) 225-2520 (except Mass. (617) 599-7990).

LOCATION—NAMU is docked at Sheraton Marina, within walking distance of Charlotte Amalie. Ten minutes from airport.

TRANSPORTATION—Air: Air Florida, American, Delta and Eastern from Miami, Prinair form San Juan. Charters: several airlines form San Juan. Ground: taxi from airport for $2.50. Pick up can be arranged anywhere in USVI's or BVI's by yacht.

ACCOMMODATIONS—NAMU, a 53' luxury cruising yacht equipped for diving. Skippered by divers. Yacht is equipped with full galley, serving meals with an international flair, library, private head and freshwater. Two double staterooms for 2 couples. Chase boat, air compressor, depthfinder and marine radio. You and your host plan cruise itinerary, crew has over 20,000 miles experience. Rates: $100/day per person, all inclusive, no extra charges.

DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **yes**	Drift dives **no**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **yes**	Beach dives **yes**

DIVING EQUIPMENT—Mako compressor, 3200 PSI, 12 tanks. Boston Whaler with 25HP out-board, fishing poles and tackle, bac pacs, weight belts, regulators, pressure gauges, BC's, wetsuits, mask, fins, snorkels and 2 U/W cameras. All equipment included in daily rate.

DIVING SERVICES—PADI affiliation. Two divemaster/guides. Resort course and snorkel lessons upon request. Full certification with instructor available $350. Unlimited diving/snorkeling, swimming, sailing, beach exploring and relaxing. Dive sites selected to fit your interest and skill level.

DIVING PACKAGES—8 days/7 nights for $700 per person. Includes accommodations, 3 meals/day, all dive equipment.

Caribbean Yacht Charters



DIVE OR CHARTER
NAMU
IN THE VIRGIN ISLANDS
ON YOUR OWN PRIVATE SAILING YACHT.

R/V BLACK CORAL CRUISES— VIRGIN ISLANDS

Homeport, St. Thomas, USVI 00801. Phone: (516) 666-3127.

RESERVATIONS: Research Vessel Black Coral, 108 W. Main St., Bay Shore, N.Y. 11706. Phone: (516) 666-3127.

LOCATION—Vessel is docked at diving club pier in Charlotte Amalie, within walking distance of town. 10 min. from airport.

TRANSPORTATION—Air: Air Florida, American, Eastern from Miami and other major cities, Prinair from San Juan. Charter: several airlines from San Juan. Ground: taxi from airport $2.50, car rentals at airport.

ACCOMMODATIONS—R/V Black Coral is 68' research vessel with 6-100 GM diesels, USCG approved for 48 divers. Quarters include 6 carpted staterooms, carpted salon, 2 showers, 2 heads, full galley. Complete electronic equipment with radar, auto pilot, VHF marine radio, AM & CB radio, stereo, side scan sonar. Also has stabilizers, twin crow's nest, and outriggers. Visa, MasterCharge accepted.

DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **yes**	Drift dives **yes**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **yes**	Beach dives **yes**

DIVING EQUIPMENT—3 compressors, 3000 PSI, with 7 bank cascades, 30-80 cu/ft tanks. 3 chase boats, dive platform stairwell, shark cage, U/W propulsion vehicles, U/W metal detectors, hard hat with communications, 100' of air hose. Full line of diving equipment and cameras for sale or rent and color processing lab on board. Film in stock.

DIVING SERVICES—PADI, NAUI, YMCA affiliation, 4 instructors/4 divemasters. Diving courses include full certification, advanced open water, wreck diver, U/W photography and deep diver. Basic and resort courses available. Rates negotiable, includes equipment.

DIVING PACKAGES—8 days/7 nights $690 per person double occupancy, $575 non diver. 4 days/3 nights $425 per person double occupancy, $350 non diver. Includes accommodations, welcome drink, diving equipment, unlimited air and dives, 3 meals daily, airport transfers, tax and gratuities, photo clinics, night and wreck dives plus more. Write for free brochures.



SAPPHIRE BEACH/WATERSPORTS CENTER— ST. THOMAS, U.S.VIRGIN ISLANDS

Box 8088, St. Thomas, U.S.V.I. 00801. Phone: (800) 243-5030.

RESERVATIONS: Sapphire Beach Resort and Village, c/o Kim Restivo, 33 Riverside Ave., Westport, CT 06880. (800) 243-5030 or (203) 226-5323.

LOCATION—Situated on 33 acres of land on the far East end of St. Thomas. The Dock Shop located on Cruz Bay dock in St. John. Five miles from downtown and six miles from airport.

TRANSPORTATION—Air: Air Florida, American, Delta, Eastern from Miami. Prinair from San Juan. Charter: several airlines available from San Juan. Ground: Taxi from airport $5.00/2 people, rental cars available at the front desk.

ACCOMMODATIONS—130 air conditioned units include either beachfront rooms or village apartments with fully equipped kitchens. Largest natural sand beach on St. Thomas. Tennis, boutique, sailing and swimming in the bay or one of two freshwater pools. Two restaurants and bars. Rates: Beachfront, single $45, double $50. Village Studio $48, Suite $58, Villa $95. Extra person $5/day, MAP $16pp/day, 10% service charge in lieu of gratuities.

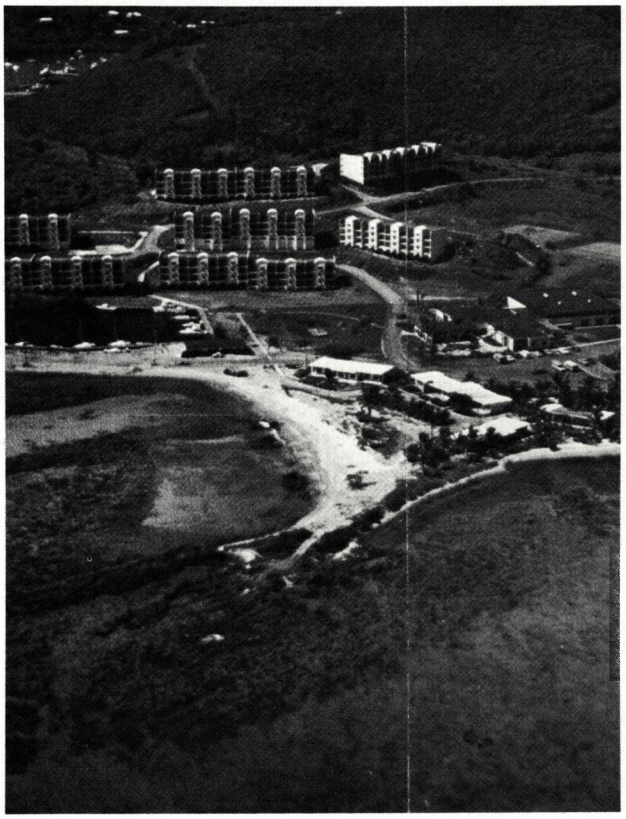
DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **no**	Drift dives **yes**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **yes**	Beach dives **yes**

DIVING EQUIPMENT—2 Mako compressors, 5000 PSI. Eighty 72 cu/ft tanks. 5 dive boats include 26' Chris Craft with diver capacity of 6 per boat. Rates include gear. U/W camera $15/half day.

DIVING SERVICES—PADI, NAUI, YMCA affiliation. Five instructor/divemasters available. Resort course $25, full certification $175, advance courses $100, U/W photography $15. Cost/half-day diving $25, full day $50, night dive $30. All are boat dives. Film in stock.

DIVING PACKAGES—8 days/7 nights for $298 per person double occupancy. Includes choice of accommodations, welcome Rum Punch cocktail, use of tennis courts, fresh flowers in room, admission to Coral World, 3 half day dives, full day dive to RHONE wreck, all equipment needed. Ask about our snorkel and non diver specials.



SALTY DOGS/REEF BEACH RESORT— ST. CROIX, U.S. VIRGIN ISLANDS

Teague Bay, Star Route, St. Croix, USVI 00864. Phone: (809) 773-3232

RESERVATIONS: The Salty Dogs, Inc., 59 Kings Wharf, Christiansted, St. Croix, USVI 00820. (809) 773-2678. Or HTR, Inc., 500 Madison Ave., NY, NY 10022. Toll free (800) 221-4588 (except NY (212) 355-6605).

LOCATION—Resort is on north coast, opposite Buck Island Nat'l Park. Boat is on waterfront, in heart of downtown. 20 minutes from airport.

TRANSPORTATION—Air: Air Florida, American, Eastern from Miami and other major cities, Prinair from San Juan. Charter: several airlines from San Juan. Ground: Taxi from airport $3, car rentals at airport

ACCOMMODATIONS—Resort is self-contained. Beautifully furnished 1 & 2 BR villas with A/C and private patios overlooking the water. Convenience store, laundry service, golf, tennis, open air restaurant on 1200' beach, complete water sports including sunfishing, windsurfing, parasailing. Summer rates: 1 BR villa, single $30, double $42, triple $50, quad $60, 2 BR villa, triple $69, quad $70, quint $80. Major credit cards accepted. *TWENTYONE*, 65' Italian trawler has 5 carpeted staterooms, 4 baths, 5 showers, recompression chamber, 2 compressors, 2 chase boats. Accommodates 6 divers. Rate: $833 per person/wk. includes meals, drinks, all diving gear, captain, divemaster, cook.

DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **yes**	Drift dives **no**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **yes**	Beach dives **yes**

DIVING EQUIPMENT—3 compressors, Mako, Bauer, Bristol, 5000 PSI. 42 single tanks, 10 doubles. 3 boats include 47', 31' 27', diver capacity 42.

DIVING SERVICES—All major certifications, 2 divemasters. Resort course $35, single tank dive $25, double tank dive $40, night dive $30.

DIVING PACKAGES—7 days/6 nights $296 includes 5 tank dives; 5 days/4 nights $194 includes 3-2 tank dives; per person/double occupancy. 7 days/6 nights $350; 5 days/4 nights $230; per person/single room. Packages include gear, U/W camera/day, beach privileges, cocktail party, welcome drink, intro. scuba lesson, glass bottom boat trip to Buck Island if stay 7 days or more.



ST. THOMAS DIVING CLUB/VILLA OLGA—ST. THOMAS, U.S.V.I.

P.O. Box 4976, St. Thomas, U.S.V.I. Phone: (809) 774-1376.

RESERVATIONS: St. Thomas Diving Club, c/o Richard Doumeng, P.O. Box 4976, St. Thomas, United States Virgin Islands 00801. Phone: (809) 774-1376. Wolfe International, New York, New York. Phone toll free: (800) 223-5695 (except NY (212) 730-8100).

LOCATION—The club is located on a secluded peninsula on south side of island within walking distance from town at a seaside hotel. One mile from Harry Truman Airport, ten minutes by taxi.

TRANSPORTATION—Air: Eastern, American, Delta, and Air Florida from Miami, San Juan and other major cities, Prinair from San Juan. Charter: East Caribbean Airlines from San Juan. Ground: Taxi from airport $2.00 for two people, major car rentals available at airport and downtown locations.

ACCOMMODATIONS—Fifteen room seaside Villa Olga Hotel, most with water views, all have private bath. Rooms have either ceiling fan or air conditioning. Main house is a gracious old West Indies guest house complimented by hillside cottages and beachfront rooms with views of neighboring islands and the Charlotte Amalie Harbour. Club was host for CBS-TV Sports Spectacular Shark Tagging Competition. Complete resort facilities include Villa Olga Restaurant with unique seaside open air dining room and bar, full service Pro Dive Shop, marina, private beach and protected swimming area, daily maid service, nightly entertainment, including steel band and special dive club underwater photography slide presentations. Other recreational activities that can be arranged include waterskiing, fishing, boating, tennis and golf. Total beds for groups of forty. Rates: single for $32, double for $36. Master Charge, Visa, Diner's Club, and American Express credit cards accepted.

DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **no**	Drift dives **no**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **yes**	Beach dives **yes**

DIVING EQUIPMENT—Worthington compressor, 3000 PSI. Fifty aluminum tanks each one eighty cubic feet. Six boats available with two boats docked at club. Includes *GOLDIELOCKS*, new 1978 43' fiberglass diesel specially-designed dive boat with total capacity for forty divers. Boat has large dive platform, walk through stern for easy entry and exit, tank racks and benches with gear storage underneath. Captain and head instructor for Club is Armando Jenik. Fully stocked dive shop includes latest equipment, as well as t-shirts, sunglasses, suntan lotion and bathroom notions. Rental equipment includes tank/bac pac $5/day, mask snorkel $2/day, weight belt/lead $2/day, regulator with gauge $5/day, fins $1.50/day, underwater camera $20/day. BC's and wet suits are also available on request. Club has a full line of Kodak film and can arrange for twenty-four hour ektachrome film processing. Divers can show slides on 15' x 12' projection screen in cocktail lounge with club's multi projectors and dissolve unit.

DIVING SERVICES—PADI and NAUI affiliation. Five instructors and three divemasters. All instructors are certified and licensed with years of local experience. Resort course $25, full certification $175. Advance courses and underwater photography course available on request. Cost for one half-day diving $50, includes two tanks, cost for full day diving $75, includes three tanks, cost for night dive $35, does not include light. Tank/bac pac and weights are included in the daily rates. Dive shop posts today's and tomorrow's dive schedules so a diver has the opportunity to make three dives a day. Club can arrange for more dives each day for divers who want to spend the maximum time diving. Just confirm with shop and be on dock fifteen minutes before departure. Dives are preplanned to insure maximum time underwater. Complete briefing before dives to determine individual skill level to insure safety and enjoyment on each dive. Boats and dock are a short walk from dive shop. All boats have licensed Captains and are U.S. Coast Guard approved. Hundreds of dive sites available in the Virgin Islands include the Wreck of the RHONE, site for filming of the movie, "The Deep". Other sites include: Major General Rogers Wreck, Cow and Calf, French Cap, Coki Beach, Thatch Cay Tunnel and Sub Base Pier.

DIVING PACKAGES—Eight days and seven nights for $398 per person based on double occupancy. $342 per person based on third or fourth person in room. $482/per person based on single occupancy. Includes hotel accommodations, eighteen boat dives, including an all day trip to the RHONE wreck, a welcoming Sunday cocktail party and an underwater photography slide show. Tanks, bac pac, weight belts and air fills are also included. Special non diver package for $165 per person based on double occupancy includes three special outings, all day sail to St. John, tour of the island, visit to Coral World underwater observatory. Write or call today for free brochure at reservation address.

St. Thomas Diving Club at Villa Olga
A DIVERS RESORT
ST. THOMAS, U.S. VIRGIN ISLANDS



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In N.Y. 212-730-8100
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V.I. DIVERS LTD.— ST. CROIX, U.S. VIRGIN ISLANDS

Pan Am Pavilion, Christiansted, St. Croix, USVI 00820. (809) 773-6045.
RESERVATIONS: V.I. Divers Ltd., c/o Bret Gilliam, Pan Am Pavilion, Christiansted, St. Croix, USVI 00820. (809) 773-6045. (809) 773-0210.

LOCATION—Dive Store: located downtown Christiansted near waterfront and harbor, within walking distance of shopping and historical sites. Second facility in Christiansted harbor on private 250 foot pier. Ten minutes from Alexander Hamilton Airport. Hotel: located in center of downtown, one block from dive store, near waterfront, shopping and other attractions. Ten minutes from airport.

TRANSPORTATION—Air: Air Florida, American, Eastern from Miami and major cities to St. Croix, Prinair from San Juan, Antilles Air Boats from several island locations. Charter: several airlines available from San Juan. Ground: taxi from airport $2.50, courtesy car pickup for groups, major car rentals at both airport and downtown.

ACCOMMODATIONS—Club Comanche: Forty-six room hotel furnished in period antiques, such as four poster canopy beds and a cage elevator, is pleasant escape from modern atmosphere hotel properties. Complete facility includes: saunas, masseuse, large salt water pool, unisex hair salon, liquor store, bar, lounge, restaurant, gift shops, private docks, full service retail dive store with complete line of equipment for sales, service and rentals. Rooms have balconies and telephones. Arrangements made for recreational activities include golf, tennis, sailing, fishing, and water skiing. Rates: single $28, double $50. Major credit cards and travelers checks accepted.

DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **yes**	Drift dives **no**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **no**	Beach dives **yes**

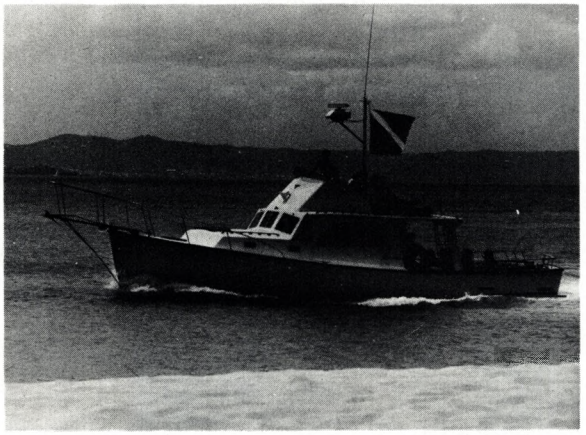
DIVING EQUIPMENT—Two Mako compressors, 5000 PSI with 9000 PSI air bank capacity. Seventy-five tanks with fifty-five 72 cu/ft and twenty 80 cu/ft. Two dive boats include SUNDANCE II, a 52' fiberglass diesel powered custom boat. Full electronics, VHF radio, auto pilot, stereo system, USCG licensed for forty people, can sleep ten persons for overnight trips. Full width dive platform, stern door walk through for easy entry and exit, 110 volt power, two freshwater showers, fully carpeted and complete line of diving equipment on board. Can cruise at speed of 24 knots loaded, Captain is Bret Gilliam. Second boat, SEA TREK, is a 46' fiberglass diesel powered custom boat. Can sleep six people, has VHF radio, autopilot, stereo system, dive platform, seven kilowatt generator, freshwater shower and compressor on board. Can cruise at speed of 14 knots loaded, Captain is Ron Cutler. Dive store has complete inventory of equipment for sale or rental, includes tank/bac pac $3/day, mask/snorkel $2.50/day, weight belt/lead $1.50/day, regulator $3/day, fins $1.50/day, underwater light $2/day, underwater camera $10/day with electronic flash $20/day. Film in stock and forty eight hour processing available for $5/strip.

DIVING SERVICES—PADI, NAUI, NASDS, SSI, YMCA, CMAS affiliation. Five instructors and four divemasters. Resort course $35, open water certification $225 (six dives), advanced training $150, deep diving $150, underwater photography $225 and other courses available on request. Cost for half day diving $30 for two dives, cost for full day diving $40 for three dives, cost for night dive $25. Tank, bac pac, weight belt, regulator and stabilizing jacket with inflator included in dive rate. Dive store can arrange for more dives each day for divers who want to spend the maximum time diving. Special trips can be arranged such as trips to THE RHONE, three day British Virgin Island cruises, overnight trips and dive/sail cruises throughout Virgin Islands. Please write in advance to make special arrangements.

DIVING PACKAGES—Eight days/seven nights for $350 per person based on double occupancy, $380 per person based on single occupancy. Includes accommodations, thirteen dives, breakfast, tax and gratuities, courtesy airport pickup for groups. Six days/five nights for $285 per person based on double occupancy, $315 per person single occupancy. Includes same as above package except nine dives instead of thirteen. Four days/three nights for $170 per person based on double occupancy, $200 per person single occupancy. Includes same package as other two except only five dives. Complete certification course package for $360 per person double occupancy or $390 per person single occupancy. Nationally certified instructor will give personal individualized instruction for six days on all phases of scuba training and upon graduation receive credentials from NAUI and PADI. Rate includes equipment, diving fees, books, certification fees, accommodations, taxes, and breakfast. In addition to listed packages, customized packages available to meet requests on inquiring divers. Packages are commissionable to travel agents and group leaders, write today for free brochure at reservation address.

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Bret Gilliam, *President*

Bill Walker, *General Manager*

Product Survey:

Scuba, Size Small

Good equipment means a good fit—and more divers than ever before are getting it.

PHOTOGRAPHY BY RICK FREHSEE



There was a time when the most obvious difference between men and women divers was that the men's equipment fit.

Until recently, women were forced to contend with too-tall tanks, baggy BCs, miserable masks and fins that fit like clown shoes. Women could pay more to get a custom made wetsuit but even then the cut was often wrong.

Equipment manufacturers know there's a difference between men and women. They were young once. The reason they ignored the fact on the assembly line is simple. Five years ago, only about five per cent of diving students were women. When those five per cent moved from textbook instruction to the water, they quickly discovered the misery of coping with man-sized gear. Many simply gave up. Those who managed to adapt using socks, tape and determination represented a market too small to be profitable to any manufacturer. The bottom line unfortunately takes precedence over the curve.

The situation was worse for small men. While a woman had several undeniable



Far left: ***Cressi-Sub*** *introduces a new 70.6 cu. ft. tank that weighs 22 lbs. and stands only 22.5" high; $135.* ***White Stag's*** *18" contoured Super Stag is one of the smallest backpacks available; $37.50.* ***Tekna*** *has eliminated bulk and needless weight on their T-2000 regulator; $189.95.*

Left: ***White Stag*** *redesigns its women's shorty wetsuit with high French-cut legs; $80. Also new Caribbean low-cut boots from White Stag; $17.50.*

Below: ***US Cavalero*** *Mini-gymnot mask; $11.95.* ***Farallon*** *moldable mouthpiece snorkel; $7.95.* ***AMF Voit*** *Mini Duck Foot fins for children; $5.*





Left: ***Cressi-Sub*** *incorporates all the features of their top-of-the-line Piuma mask into the new Piuma, Jr. model; $19.90.*

Below: ***Seasuits*** *offer comfort in style with brand new colors. Full coverage wetsuits now come in brown, green, and navy blue; $125.* ***Scubamaster*** *solves the smaller diver's weight belt problems. The nesting weight system comfortably adds 10 to 22 lbs. with sculpted 2 and 3 lb. weights which fit into body hugging 5 lb. master weights. Strap with two 5 lb. weights; $27.80.*

Bottom: ***Sub Aquatic Systems*** *creates especially for women the new Inflatable-Comfort Suit. Nylon 2-sides maximizes warmth and comes in an attractive blue & orange combination; $400.*





continued



excuses for discomfort wearing equipment designed for men, the small man many times felt trapped by peer pressure. In a class composed of predominantly male students, macho attitudes are inevitable. The embarrassment proved too great for many smaller men to admit their discomfort with bulky equipment and an annoying sloppy fit.

But as the numbers change, so changes the marketplace. Women diving students now represent 20 per cent of some schools' enrollment. Children are learning to dive before they can drive, and even smaller men are finding top-flight equipment in snug-fitting sizes.

Innovative technology has produced smaller, lighter and more comfortable equipment for divers small or large, male or female. Progress is slow; don't expect to find all the items on the next few pages in your local dive shop tomorrow morning. But competition fuels the fires of industry, and more manufacturers are enviously eyeing profits earned by those who tooled up early to produce scaled down gear.

The products pictured here aren't the only ones made; they represent some of the

continued

Left: ***Seatec's*** *Baby Bluefin is a small stabilizing vest for divers 5' to 5'6" tall. It provides 35 lbs. of buoyancy with a comfortable harness designed to eliminate "riding up" when worn by women; $200.*

Below: ***Scubapro*** *provides a scaled down wraparound buoyancy jacket. Compact, yet with full lift capacity, the jacket affords heads-up flotation and the security of two CO_2 emergency inflators; $230.*

Opposite page (clockwise from top left): ***US Divers*** *model 7705 BC; $149.95.* ***Seaquest*** *extra small M-94 BC; $100.* ***Dacor's*** *new CV60 BC; $135.* ***Sportsways*** *Deluxe Waterlung 1867 BC; $87.50.*




SPORTSWAYS
DACOR





more creative and prettier pieces on the market. A California instructor, Cheri Boone, has compiled an excellent list of smaller equipment available in the U.S. Her research is available from the NAUI Helpline, National Association of Underwater Instructors, P.O. Box 630, Colton, CA 92324.

Left: ***Parkway*** *Grabber glove fits even the smallest hand like a second skin, providing greater finger mobility. The five finger glove features durable nylon construction and over-edge stitching on the cuff; $23.90.*

Below left: ***Selpac*** *Mini-dagger incorporates the features of a full sized dive knife in a more compact nine and three quarter inch size. Fine stainless steel five-inch blade has serrations for tough cutting jobs; $18.50.*

Below: ***Seapro*** *Mini-Retractable At-Pac is the only back inflation unit to provide complete freedom of attitude control for the short-waisted diver. This compact unit provides 50 lbs. of lift; $281.50. Optional ABS plastic fairing available in six colors; $115.*



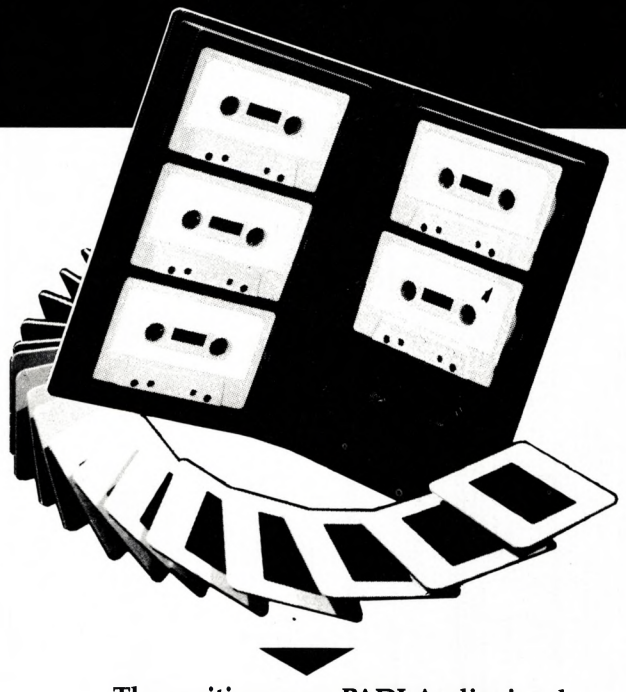

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HOWARD HALL

Comparing Films for Color

The color in your underwater photographs is largely determined by the film you choose.

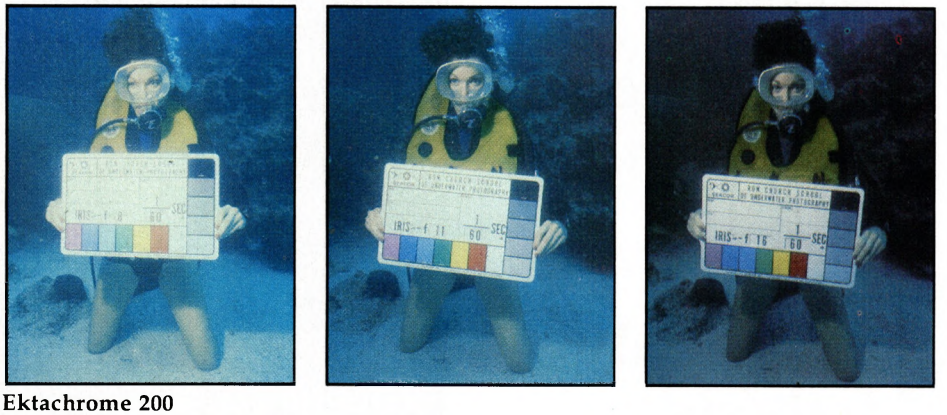
BY STEPHEN FRINK



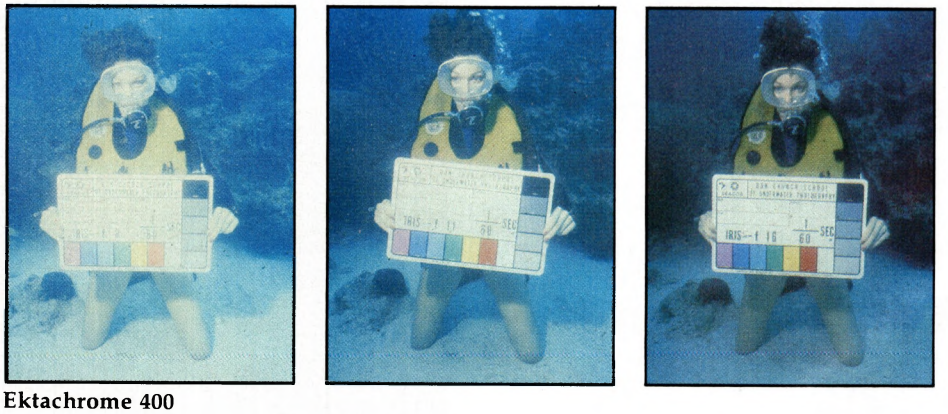
Agfachrome



Ektachrome 64



Ektachrome 200



Ektachrome 400

Achieving a pleasing color balance in your underwater photographs is difficult. Water acts like a color filter, virtually guaranteeing results dominated by blue or green. You do have some control, however, through the film you choose to shoot.

Each year the photographic magazines publish research evaluating the various films. Color, exposure latitude, resolution and contrast are tested. These factors naturally have relevance for the underwater photographer, but a more important consideration may be how each film will record the aquatic scene.

Seven of the most popular color transparency films have been tested under identical conditions. By analyzing the results, you should get a good idea of how each film will record the same scene. It is apparent that the films exhibit subtle differences in color, and not-so-subtle differences in sensitivity to light. The choice of film stock is usually based on a number of factors.

Color is a subjective variable. Some photographers like the rich, royal blue water afforded by Ektachrome. Others find the accuracy of skin tones on Kodachrome more important despite the greenish tinge of the water.

Beyond color, the film's sensitivity to light is critical. Underwater, the photographer usually cannot adjust shutter speeds to achieve a desired aperture. In recording a stationary subject above water you may choose a fine grain, high resolution film, use a slow shutter speed, and still obtain good depth-of-field as a result of a small aperture with a tripod-mounted camera. Underwater, the sub-

Stephen Frink's photographs appear regularly in ***Sport Diver.*** *He teaches underwater photography and operates a custom processing lab in Key Largo, Florida.*

Film Type	Water Rendition	Skin Tones	White Rendition	Grain	Contrast	Exposure Latitude
Ektachrome 64	Ektachromes reproduce the water best.	Skin tones in the Ektachromes are cool.	Predictably, whites are cool also. Picks up same bluish cast evident in skin tones.	Sharp, crisp, high quality film. Very similar to K-64.	Lowest in contrast of the Ektachromes. Perhaps too flat for available light work but holds strobe lighting very well.	All three Ektachromes seem to hold one stop over and under well.
Ektachrome 200	Contrast slightly increased over E-64. Brings subject out from water.	Perhaps slightly warmer than E-64, but still bluish.	Due to increased contrast, slightly cleaner white than E-64.	Grainier than E-64, as one would expect from the increased ASA. Still very acceptable.	Good available light film due to slightly higher contrast.Shadows may tend to block up with hot lighting.	Surprisingly nice in exposure latitude. Over and under in strobe lighting shows up first in highlights & shadows.
Ektachrome 400	Very similar to E-200 in most respects. Clean blues.	Cleanest skin tone of the Ektachromes. Excellent for a 400 ASA film.	Best white of the Ektachromes, although difference between E-200 and E-400 is negligible.	Beautiful film for its speed. Nearly as sharp as E-200 but one stop faster. Excellent for extending depth of field.	Excellent available light film. Perhaps too snappy for subtle strobe lighting. Highlights may burn out.	In test, minimum aperture of f-16 was wide for ASA 400. Film appears to be tolerant.
Kodachrome 25	Water greenish in cast.	The Kodachromes are best for skin tones. 25 looks good, but may be too slow.	Good white. Relatively pure rendition for underwater use.	Traditional sharpness champ.	Contrast resembles E-64 overall.	Very similar to E-64 in latitude. Experienced same problem at f-3.3 as 400 had at F-16.
Kodachrome 64	Close to K25 in color. As with most faster films, better subject/water separation than K25.	For tight portrailture, probably best film. Water will still be green, but skin will appear natural.	Colors on Seacor board reproduce accurately. Whites look good.	Slightly less crisp than K-25, but still excellent.	Only slight variation relative to K-25. Good shadow detail when lit properly.	Exposure leeway between K-25 and E-64 virtually indiscernable underwater.
Fujichrome 100	Definitely green. May be more acceptable in non-Caribbean waters.	Very acceptable skin tone underwater. A bit warm for topside use, but reproduces the u/w subject well.	As in all of the warmer films, whites look good. Closely parallels Kodachromes.	K-64, E-64 and Fujichrome 100 are all very close in terms of grain and overall resolution.	Contrast within acceptable standards. Seems to perform well.	One stop over and under may be acceptable. No alternative to being right on with exposure though.
Agfachrome 100	Subjectively poorest rendition of water. Greenish and relatively muddy appearance.	Good flesh tones. Reds and yellows reproduce well with skin natural in appearance.	No problems with whites in this emulsion.	Seems to be as grainy as any film tested. Very weak in this regard for an ASA 100 film.	Contrast slightly lower than Fuji, but not a problem with strobe lighting. A little flat for available light.	Seems to hold the standard one stop over and one stop under. All films tested are barely the same for underwater use in this regard.



Fujichrome



Kodachrome 25



Kodachrome 64

ject is rarely stationary, and if it is, the photographer is not. Since a great deal of underwater photography is done with strobe and a focal plane shutter, the synchronizing shutter speed is generally fixed at 1/60th of a second. Therefore, given a level of ambient or electronic illumination that is relatively inflexible, choice of working aperture becomes a function of film ASA.

It is apparent that Kodachrome 25 will allow little room for focusing error as a result of the large aperture required in fish portraits or people shots. However, for macro photographs, everything is shot at f-22 and the exposure determined by strobe-to-subject distance. For this purpose, the excellent resolution of slower film emulsions make them the logical choice.

In terms of resolution, the differences between the fast and slow films are not as dramatic as they once were. The new E-6 Ektachromes, particularly ASA 64, appear to be similar to the Kodachromes. Kodachrome 25 is still the finest-grain slide film on the market, but Kodachrome 64 and Ektachrome 64 are very close. Fujichrome 100 is right in there as well. Agfachrome 100 exhibits greater granularity, but resolution is still very acceptable. The high speed Ektachromes, ASA 200 and ASA 400, are naturally a bit grainier than the others. Compared to the old E-4 high speed films these are beautiful emulsions. And in some instances, these films do what no others will. In available light work where a combination of small aperture and fast shutter speed is required, or on a wall with little ambient light and strobe fill, the fast films may be the only way to get the shot.

In choosing which film best suits your needs, consider also the availability of both film stocks and processing. Agfachrome is hard to find and has to be returned to New York for prepaid processing. It took almost three weeks for the test roll to be returned. The Kodachromes are much better. In large cities 24-to 48-hour processing is available; and even via prepaid mailers, one week turnaround is common. The E-6 films are the most easily processed. Fujichrome is harder to find than the Ektachromes, but both film stocks may be processed in the home darkroom, by commercial labs, or returned to Kodak.

continued

Test Procedures

While the ocean is not amenable to strict experimental controls, the variables that may affect film performance have been reduced by shooting all seven rolls on the same dive, in the same location with the same equipment and subject.

Two Nikonos III cameras with E-O connectors were used. The same Subsea Mark 150 strobe was used for each shot. Seacor 21mm lenses were used on each camera so that the exposure board, skin tones and water color could be included. Model Janette Weeks remained as motionless as possible throughout the shooting. An assistant was used to swim the cameras to a boat where the film was changed. This allowed the photographer to remain in position during the shoot.

Three apparent feet separated photographer and model with water visibility at approximately 35 feet. Depth was 27 feet on a bright, sunny day. All exposures were made between 1:30 and 2:30 p.m., with a Sekonic L-164 meter indicating an ambient light level providing proper exposure at f-5.6 and 1/60th of a second for ASA 64 film.

All of the E-6 compatible films were processed in the same basket line run (Ektachrome 64, 200 and 400, and Fujichrome 100). The Kodachrome 25 and 64 went directly to the Kodak processing lab, while the Agfachrome 100 was processed by Agfa in New York.

Underwater Photography/With the Pros:

Planning Makes Perfect!

Setting a goal for each dive and developing a plan to reach it are essential. Here are 20 ways to make that easier.

BY RICK FREHSEE



To rely totally on luck or circumstance when photographing underwater is a lot like a blind date; you can hope to be pleasantly surprised, but usually the results don't live up to your expectations.

The most memorable underwater photographs, especially of people, are those that appear to be natural and spontaneous but are actually the result of careful preparation and planning. Very few of my better photographs are surprises. I spend the majority of working time scouting locations, waiting on the weather, arranging for models, briefing the participants and planning and preparing each set-up. In some instances the actual taking of the photograph is a relatively small part of the process.

Before you dive each day you should have a goal for that day's shooting, a plan to accomplish it and a thorough understanding with your model as to how the plan will be carried out.

The plan should account for the types of photographs you want, the locations for the shots—a certain sponge or the wheelhouse of a wreck—and the feel you envision in the finished photo. With time, you will begin to mentally see your photographs before they're taken, perhaps even the night before.

Most good photographers start out with an image in their mind's eye before they press the shutter. Then they go to work to make it happen and appear natural to the camera. As they focus and frame the composition through the viewfinder, they pre-visualize the scene and shoot when it takes form. As you progress and gain experience in pre-visualization you will begin to feel the success or failure of a photograph seconds after you make the exposure. It's this feeling for what the scene will look like on film that determines the champs in underwater photography. And anyone can improve their skill with practice.

To achieve the previsualized image while overcoming the problems of limited bottom time, thermal protection and lack of voice communication demands an organized approach. As we plan our dive and dive our plan we must also provide for a photo plan to reflect priority photographs; communications, whether they are to be written messages on plastic slate or arranged through hand signals, must be simple and direct.

There are times of course, when you must shoot the action as it occurs.

Rick Frehsee is a regular contributor to ***Sport Diver.*** *His photos have appeared in* ***Life*** *and dozens of other magazines, as well as a number of national advertising campaigns.*





Above: A candid shot like this may take three to four people to stage and execute properly (below).

This is a kind of underwater photo-journalism and may be hit or miss. The kind of underwater photography that I am describing is best called photo illustration and it is planned in advance. This always yields the best results in the shortest period of time.

The schedule of a recent shooting session on an island in the Caribbean illustrates my approach.

A major manufacturer of diving equipment has sent us here to shoot photographs for their annual advertising campaign.

Your goals for a vacation or weekend shoot may be different—to produce a slide show for use at home or simply catch memorable images—but all purposes will benefit through application of these principles.

Four models were selected for the shooting, two males and two females. I have made the initial selection with final approval coming from the client. They are all certified scuba divers and two are full-time professional models.

Two briefings have taken place, one in Miami at the time of the initial meeting with the crew and again after arrival on the island. Everyone understands that professional fees demand a professional peformance. A daily schedule is set for shooting from 8:00 a.m. until 5:30 p.m. The models are to be at breakfast ready to go. This is not a simple chore; they have to get up at 6:00 a.m. The makeup the ladies wear is waterproof eyeliner, eyeshadow, mascara and foundation made by Max Factor or Revlon. For underwater work there is a certain theatrical look to makeup application but it will be muted in the water by selective color absorption.

After breakfast, from 9:00 a.m. until 1:30 p.m., we will be shooting underwater. From 1:30 until 2:00 we eat sandwiches on the boat as it heads back to the resort. From 2:00 until 3:00 the models will shower, change and reapply makeup and then, from 3:00 until 5:30, we will shoot topside. By splitting the day, we insure that some underwater and some topside photography is accomplished each day should the weather turn for the worse. Morning is selected for diving because of slightly calmer seas than afternoon.

For the first couple of days I shoot at least one roll of Ektachrome film through each of my cameras. This is developed by my assistant each night. These first results allow me to check for in-camera malfunctions, exposure, focus and framing problems, model position and how the equipment is presented.

Each morning after breakfast I meet with the models and my assistant to assess our progress and to outline priority shots for the day's shooting. Everyone must understand their assignment to the letter. It's frustrating to try to communicate effectively underwater. We have plastic slates and underwater writing paper on hand, but once I am on the bottom I would prefer to focus my attention totally on composition, color,

Twenty Ways to Improve Your Photographs

While my approach was developed to accomplish a professional assignment done with a relatively large budget, these techniques will improve anyone's photographs.

1. Don't depend on luck. Swimming along the bottom taking snapshots here and there will not produce many successful pictures. Prepare and follow through with a photo plan for best results.

2. Your photo plan should consider picture priorities. Go for the most important or most difficult photos first.

3. Don't depend on the weather staying right. Dive and photograph your rear-end off (within the realm of safety and bottom time) when conditions are ideal.

4. If the weather or visibility is temporarily poor, crop in tightly on divers for head-and-shoulders shots or concentrate on macrophotographs.

5. Pay attention to detail. Use waterproof makeup for ladies, and color coordinated swim suits or wet suits. Watch out for dangling straps.

6. Forget about the buddy system as it is practiced in non-photographic recreational diving. The buddy team concept is usually a farce when two photographers dive together. If you can't hire or draft an assistant who can be trusted to monitor depth, bottom time and air supply, trade off with your buddy and alternate the picture taking.

7. Re-evaluate photo priorities periodically during the time you are shooting. Critique your models' performance. It is important to let them know what a good job they are doing.

8. Use a CC30R (red) filter with strobe lighting to see in the face mask, to remove unwanted shadows and, most important, to add color and restore natural flesh tones.

9. Use the sharpest, widest, fastest lens you can afford without going into hock. The necessity for this kind of a lens increases with poor visibility and larger subjects. However, never apologize for a lack of equipment. There are cover photos that were taken with a Nikonos and a supplementary plastic lens.

10. Focus and frame your subject carefully. I do not believe in pre-setting a wide angle lens at three feet and shooting everything that way. If you want sharp photos you must focus accurately.

11. If possible, shoot and develop a few rolls of Ektachrome (E-6) the first day or two. The results will correct any errors and will help to give you and your model confidence.

12. For good topside photos too, split your day and get some of each while the weather is right.

13. Have plastic slates or underwater paper handy. A plan can be modified during the dive if communication is kept simple and direct.

14. Hand-hold your strobe to help eliminate backscatter. Hold it overhead, to imitate natural lighting and a little to the right or left, depending on which way the model is facing. Look up to re-check strobe position and direction just prior to shooting.

15. Hold your breath momentarily (only if you know that you are not drifting upwards) and squeeze the shutter gently so as not to shake the camera. Watch the composition develop through the lens or view-finder.

16. With the popular 35mm film, take advantage of vertical or horizontal format.

17. The best underwater photographs of people are usually those with a straightforward composition, shot from across or below, and maintaining a plain water background. A foreground frame or secondary subject is sometimes effective.

18. Shoot lots of film and bracket your exposures. Even the pros use this as an insurance policy against exposure problems.

19. Learn to throw most of your photos away. Only keep your very best, the ones you want to be judged by. Never show a bad shot and apologize for it.

20. Offer a set of duplicate slides or complimentary prints to your model, this will increase their desire to dive with you again. If possible, meet with the model, show all of the finished photographs and discuss why certain pictures did or didn't succeed.

continued

and lighting. If the briefing goes well there will probably be a good shooting.

I use two single 80s each morning for about one hour each, rarely more than 45 feet deep. This conserves precious bottom time.

Satisfied with our four-diver scene, for the second dive I concentrate on shooting a single diver swimming with a cooperative grouper that has been kept interested with food offered by the resort divemaster. I am dollying with the action, following the diver and the grouper by bouncing along the bottom. I rarely wear fins when shooting in tropical seas or a place with a sand or silt bottom. Fins inevitably kick up loose sediment and bottom material, and this is poison to sharp photography when using a strobe. The snow-like cluster of particles lit by the strobe, called backscatter, has ruined many otherwise great underwater photographs.

Our model stops swimming momentarily, and the curious grouper approaches quite closely, leading up to what might be a kind of decisive moment. I move in cautiously. My camera is pre-focused and through the housing I can see when the focus is sharp and the framing is right. I turn the camera sideways for a vertical format and glance upwards to check my strobe position. The scene looks good and I shoot it three times, bracketing the exposure by moving my strobe in and out rather than changing f-stops, as I am sure of the available-light exposure. The resulting photograph is used for a three foot by four foot poster, and our preparation and care has paid off.

This kind of preparation can pay off for you in better photographs—but only if you do it right. Be thorough. Write down your objectives for each day. If you know the area well, plan to use specific locations for specific shots. If you don't know the area, scout it out. Try sketching your photo ideas on paper and discuss them with your model.

The kind of approach I use may seem onerous and over-complex, but the best photographs are not taken by sloppy, disorganized workers. They are taken by those who care about their craft and prepare in advance. If you care about your pictures, you'll try it too.

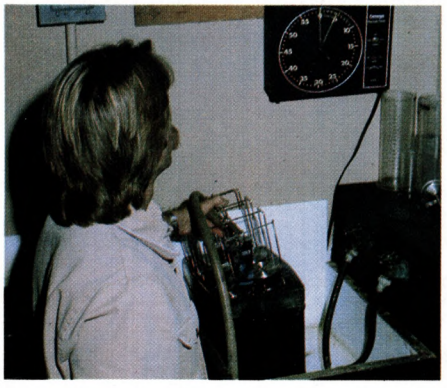
Underwater Photography/Means and Methods:

Process Your Own Slides

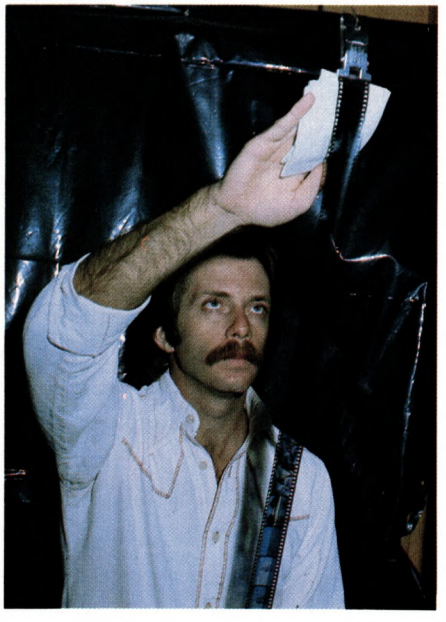
Developing E-6 at home gives you more control and saves money.

BY STEPHEN FRINK

With the introduction of the new E-6 chemistry for processing Ektachrome transparency films, more photographers are taking an interest in processing their own film. The advantages are numerous. Serious photographers use E-6 and on-site processing to check the progress of their shooting and to catch problems while at remote locations. Most underwater photography schools use E-6 films and overnight processing to show the students their previous day's work each morning before the first dive. By processing film personally you achieve greater control over results. And finally, there can be a significant cost savings.



Excepting the extra steps and temperature controls required, processing E-6 is no more difficult than developing black and white negatives.



In my shop the charge for having one roll of 135-36 processed and mounted overnight is $6.25. The gallon kit of Kodak E-6 chemistry costs $35.95 and will run at least 21 rolls of film. Chemicals, therefore, cost $1.71 per roll. Add in 36 slide mounts at $0.02 per mount, and the total cost per roll adds up to $2.43, a 62 per cent savings. The problem with these economics arises when the shelf life of of E-6 chemicals is considered. For the first developer, reversal bath and conditioner, Kodak claims a life of one week or less in partially full bottles. Deteriorating chemicals could cut into your cost savings, but there is a way to minimize waste which will be covered later.

The Process

To understand the mechanics of E-6 processing you need to have a feel for what happens in each step. Six primary chemical steps are used to develop the image.

The first developer converts the exposed silver halide grains in the film into metallic silver. The silver image that is formed is the negative of the scene photographed—that is the values light to dark are reversed. The image is composed of three superimposed but separate negatives, one each for the red, blue and green color-sensitive layers in the emulsion. This first step is the most critical to control. Variance from suggested norms will alter effective ASA, color balance, contrast, shadow density

and stain. Time in solution, temperature (100.4° F., ± ½°) and solution freshness must be closely regulated, and chemical contamination avoided.

Following the first developer is a wash cycle to end development. The temperature range is much more lenient here, 92° F. to 102° F., as it is for all succeeding steps except the color developer.

Next, the reversal bath is a chemical acting as light in exposing the remaining silver halide. No rinse is used after the reversal bath because reversal of the image from negative to positive requires the reversing agent be contained in the emulsion as it enters the color developer.

The color developer converts the exposed silver halides into metallic silver. At the same time the color developer reacts with color couplers in the film emulsion to form colored dyes. The yellow, magenta and cyan dyes are formed in their respective blue, green and red emulsion layers. Temperature for this step must be 100.4° F. ± 1.1°.

When processing Ektachrome in a small drum, a 30-second wash is advisable before adding the conditioner. This prepares the metallic silver image on the film so that it can be oxidized into a more soluble silver halide in the bleach. The conditioner also preserves the Ph of the bleach solution by reducing color developer carry-over. Improper treatment in the conditioner may cause a stain due to excessive retention of silver in the emulsion.

Some chemical carry-over between conditioner and bleach is necessary in a sink line or continuous processor. In small drum processing, carry-over is not mandatory but is helpful. Therefore no wash is used between conditioner and bleach. The bleach converts the metallic silver that formed the original image into silver salt, which will be removed in the fixer.

The fixer converts the remaining silver halide into soluble silver complexes which are then removed in the final wash. When removed, the silver leaves only the superimposed dye images, red, blue and green. These form the positive translucent image of the slide. The wash must be long and thorough. Improper washing will allow chemicals to remain in the emulsion, degrading stability of the dye.

The final step, the stabilizer, enhances the permanence of the film and acts as a wetting agent to reduce water spotting during drying.

Equipment

Because so little temperature variation is allowed and the processing temperature is far above normal room temperature, a small drum processor is the logical choice for running small quantities of film. The Unicolor drum is a double-walled plastic tank. The double wall insulates so that the high temperature of the chemicals is not lost to the lower ambient room temperature. The motor base of this unit will assure consistent agitation. If a drum unit is impractical some means of maintaining temperature during the critical first developer and color developer steps must be found. One solution is to use a stainless steel tank and a constant-temperature bath during these steps.

The constant-temperature bath may also be used to bring the various solutions up to temperature. Constantly running water at the correct temperature into a tub containing the solutions will solve the problem as long as the hot water holds out. In remote locations, this may be your only choice. But at home a more efficient method is to use a water bath temperature control device such as the Photo-Therm Constant Temperature Bath Model 14-9. The unit includes a 19 inch by 15 inch by eight inch plastic tub with pump, heater and temperature sensor. Photo-Therm claims accuracy within one-tenth of one degree Fahrenheit, and the unit retails for $150. With either the running water bath or the Photo-Therm your best bet for solution containers will be stainless steel because it conducts heat quickly, cleans easily and is less buoyant than plastic.

Mixing the Chemicals

Keeping the cost of home processing down will depend on your ability to mix the right amount of chemicals—enough to process the film on hand, but not so much that the rest goes bad on the shelf. Fortunately all E-6 concentrates come in liquid form so that smaller quantities can be drawn off to mix small amounts of working solution. Bleach, fixer and stabilizer have a mixed shelf life of 24 weeks. Assuming you'll run 21 rolls of film in six months, these can be mixed a gallon at a time. That leaves only the first developer, color developer, reversal bath and conditioner to be mixed from concentrate. The concentrates remaining in partially-full containers will deteriorate, but very slowly, and you can thus stretch the shelf life.

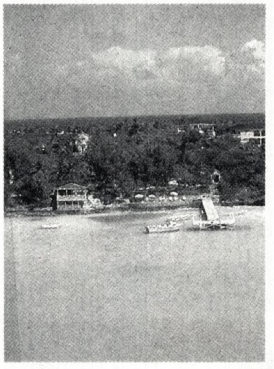
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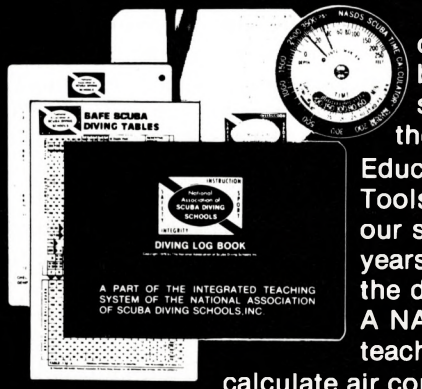
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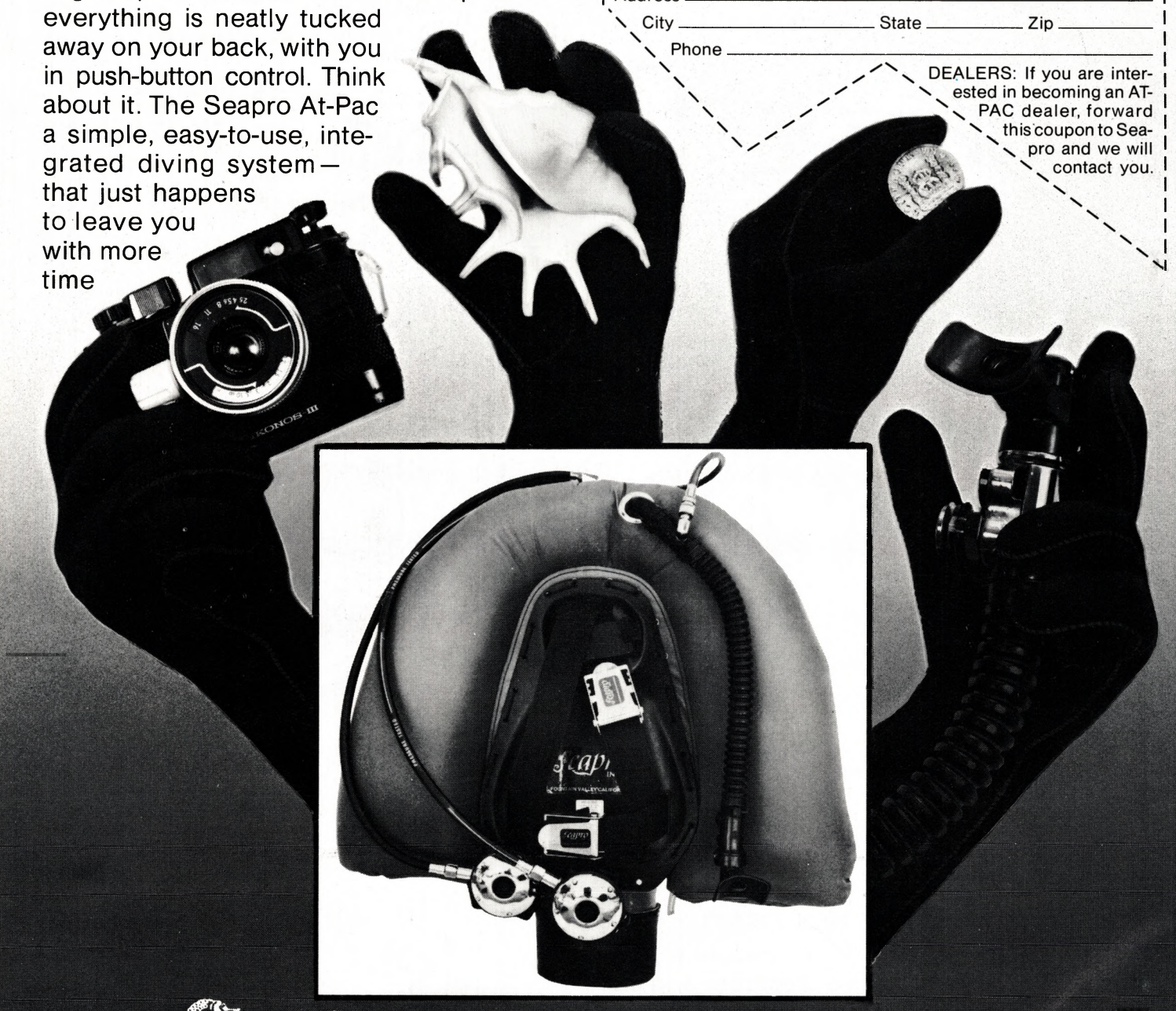
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Channel Islands Diving Destinations:

Anacapa/ Santa Barbara

Bathed in the nutrient-rich waters of the California Current, they offer spectacular, accessible diving to West Coast enthusiasts and visitors alike.

BY CARL SISSKIND

There are eight Channel islands lying roughly in the lee of the great California bight. Two of them, Anacapa and Santa Barbara, form the Channel Islands National Monument, protected and operated by the National Park Service whose local headquarters lie on the spit of land poking into the Ventura harbor. Like their sisters, these two islands offer some exceptional diving opportunities.

Both Anacapa and Santa Barbara were occupied by the Chumash Indians until the mid-1800's, but the lack of reliable fresh water sources prevented them from establishing a permanent community, and they were ultimately removed to missions on the mainland. The word Anacapa is derived from the Indian term "Ayapah" meaning deception or mirage. Approaching the island on a misty morning, you'll understand what the Indians had in mind.

After the Chumash, sheepherders used the islands for grazing and flocks are still raised—together with cattle—on Santa Cruz and Santa Rosa Islands. At one point, a try at cultivation was made on Santa Barbara but the arid conditions doomed that effort. Until the 1950s, Raymond "Frenchy" DeDreau lived in a hut on West Anacapa living off what he could take from the sea and coax from the few visitors who dropped by. While Frenchy is gone, his memory persists at one of the island's anchorages, Frenchy's Cove.

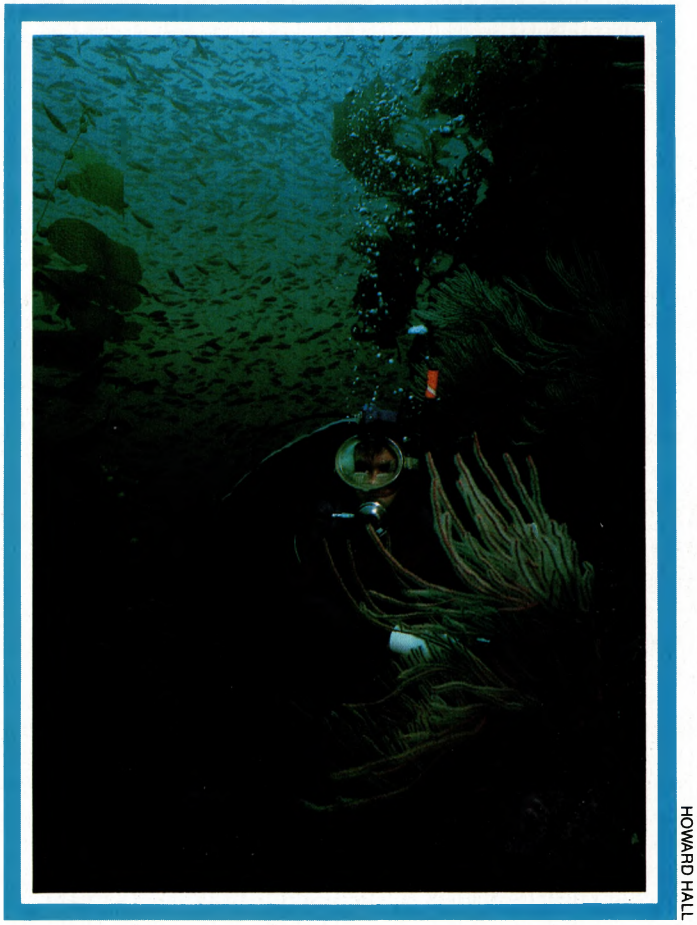
Of the four northernmost islands, only Anacapa is easily accessible to the sport diver via regularly scheduled dive boat service. The island is divided into three rocky islets which seem to offer easy passage, one to the other, by land. Actually, the only way to the place and from one islet to the other is by boat. Aircraft are forbidden to land except for government-related business, and walking is 2000 years out of style.

Charters are run from Ventura, about an hour's worth of driving northwest of Los Angeles, most frequently during the summer months when the weather and sea conditions are best. It's also the heaviest tourist time so some advance planning and reservations are probably a good idea. Other charters are available from the Los Angeles area to the south to Santa Barbara around the land curve to the northwest. It's just that Ventura is closest to Anacapa, less than 70 minutes running in any boat worthy of the name.

The weather on the islands is mild all year, pretty much in keeping with the claims of the California Chamber of Commerce. Air temperatures range from 50° to 70° F. and water temperatures lie roughly within those same parameters.

If grouping it isn't your style and you have the skill and wherewithal to latch onto a private boat, Anacapa has some neat anchorages. In keeping with the rustic nature of the place, however, there are neither moorings nor pier facilities so it's either skiff or swim to the beach. If you do plan on going ashore, remember to obtain a permit from the Park Service. Aside from Frenchy's Cove, you can toss your hook at East Fish Camp or Cat Harbor. All three places pinpoint some of the island's better dive spots.

Frenchy's is a good anchorage with a safe 20 to 30 feet beneath the keel. The bottom is hard sand and a small beach is right at hand where picnicing is permitted. (As with all the islands, you are required to remove your trash when you leave.) East Fish Camp at Middle Anacapa is all right for temporary anchorage when the strong westerlies are blowing but keep a sharp eye out for wash rocks and submerged pinnacles near the shoreline. Over on the north side of East Anacapa is Cathedral Cove which offers a lee beneath spectacular cliffs.

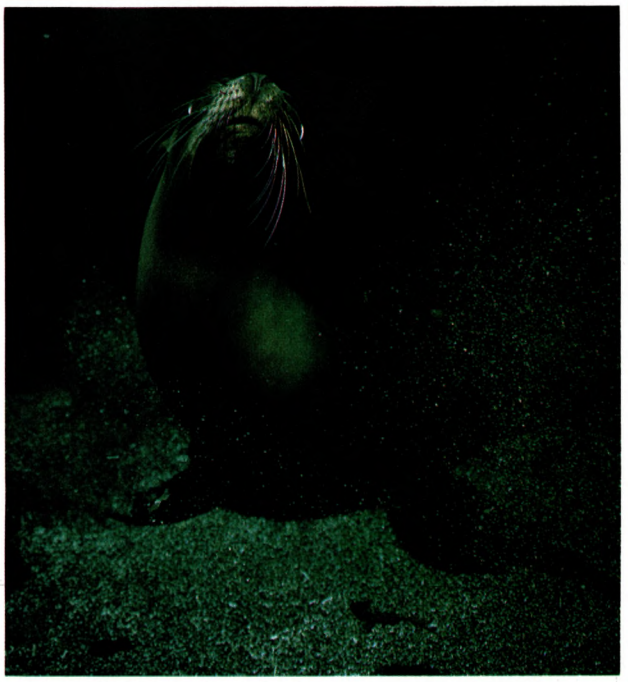


HOWARD HALL

The tip of West Anacapa has some excellent diving, particularly when the southerly swell is down. Sixty-foot visibility is not unusual. The ocean is shallow next to the islands, but falls off to hundreds of yards within a relatively short distance,

continued

Carl Sisskind is head of public affairs for the Deep Sea Drilling Project at Scripps Institution of Oceanography. He is chairman of the Advisory Board on Underwater Parks for the State of California and a former broadcast newsman for ***Time/Life.***



A harbor seal just off Anacapa Island scrutinizes photographer Snyderman.

MARTY SNYDERMAN

so go slowly on your initial plunge. Spearfishing is allowed within existing regulations set by the California Department of Fish and Game although there are three ecological reserves around the island. Some areas within these reserves have special restrictions against spearing, so it's best to check with a ranger. Once in the water, the restrictions won't bother you because the things you can take are so plentiful. Rockfish, perch, sheepshead, and halibut are common. So are scallops, abalone and lobster.

Even though Anacapa has had heavy diving traffic in recent years, the patient spearfisherman is going to get his fill. The greater attraction to many, however, is the magnificent submarine panorama. Giant kelp form an underwater cathedral accommodating a host of marine species. The main danger is running out of film. Seals and sea lions, if you are quick of eye and long on patience, can also be counted on to drop by for a family portrait.

Cathedral Cove on the north side of East Anacapa is spectacular sightseeing. In addition to the fish and plant life, there is the multi-chambered sea cave itself which is big enough to explore by skiff. Make sure that you check the surge before you enter since it can get downright hairy when the sea humps up. Under calm water conditions it's a sight for permanent placement in your memory book.

Opposite Frenchy's is the wreck of the *Winfield Scott.* A steamer that ran aground and sank on December 2, 1853, its massive paddle-wheel frames can still be seen in 20 feet of water and there's enough left of the old hulk to make an intriguing dive and some special photos.

Downcoast (eastward) from East Fish Camp is the likeliest spot to find a lush growth of kelp. Although there is usually some current running in this area, the great underwater forest provides a breathtaking kaleidoscope of light and shadow. There's also some good kelp diving at Goldfish Bowl where a sandy bottom and calmer water make things a bit easier. Fishing is not too shabby at Goldfish, either.

A stronger spirit of adventure is probably better satisfied by a trip to Santa Barbara Island. It's the smallest in the Channel group, only about 640 acres, triangular in shape and it lies about 40 miles west of San Pedro, Los Angeles' harbor. Running time for most charter boats is three to three and a half hours. It's a barren place where, according to legend, the Spaniards banished captured pirates and other outlaws. Many geologists maintain that the island is a volcanic remnant of an ancient mountain range and suggest that it may originally have been part of the Guadalupe Islands of Mexico.

The surrounding waters are another matter entirely. Because of its relative isolation, Santa Barbara isn't dived as frequently as Anacapa. Sea mammals, like California sea lions and harbor seals, abound. During late summer, there's a better than even chance for sighting elephant seals. These mighty animals, so clumsy looking and gross on land, are transformed in the water. Like seals and sea lions, they swim magnificently and look like sleek, dark teardrops zipping through the sea. Elephant seals are normally uninterested in man, which is probably just as well since full grown bulls can weigh up to four tons.

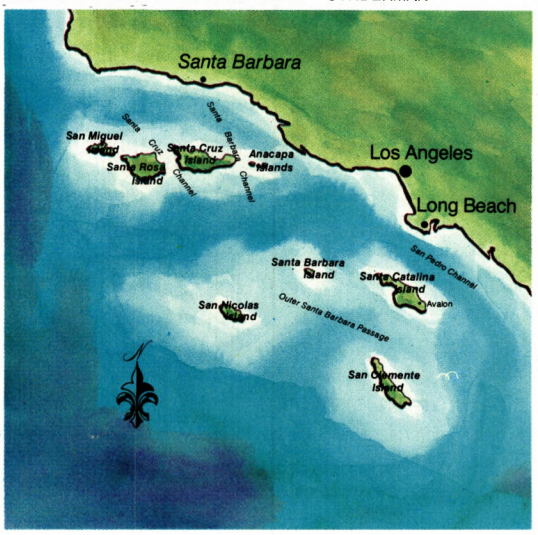
Pretty much the same ground rules apply for taking game as at other Channel islands, and the marine life is similar to that around Anacapa. Chances for nabbing a sizeable lobster are better by far than along the mainland. The best dive spots are adjacent to the north and west coasts where rugged inlets and sea-washed caves exist in great number. Another place for good diving is Webster Point at the island's westernmost extremity, but current and surge make this a spot where the novice should go lightly.

A very special time of year to visit Santa Barbara would be in December and January. If the diving bombs out, grab a golden opportunity to watch the gray whale migration. This aquatic parade is an annual event during which a mammoth flotilla makes its way from the Bering Sea southward to breeding grounds off the west coast of Baja California. Traveling alone or in groups (or pods) of as many as a dozen, the grays measure up to 40 feet in length and can be spotted instantly by the characteristic blow each time they surface. Gentle and shy by nature, the grays have made whale-watching a major aquatic event in California. Santa Barbara is well situated along their southern track and they are easily seen, often very close up, from off-shore boats and the island itself.

Still, summer and early autumn are the best times for Santa Barbara dives. It's then that visibility is best. Picture taking can be outstanding. Subjects like orange-hued nudibranches vie with the glorious yellow coral polyps for your attention. And if you are quick enough, there are squid which can flash from angry red to mottled white as fast as a neon sign. There is the brilliant orange Garibaldi, the goldfish of the ocean's aquarium, or a purple medusa which, reflecting the light from your strobe, makes an unforgettable picture. At depths up to 60 feet the strawberry anemone lies in wait, its deceptive beauty a deadly lure for tiny sea life. When its waving spikes are disturbed, the animal (and it is an animal, not a plant) closes up, leaving its red undersurface exposed. The white dots bedded in the red skin make its strawberry appearance complete.

So your choices are truly wide-ranging at Anacapa and Santa Barbara. Springtime through early fall is the best time to dive and picture-taking is more rewarding than spearfishing. Be sure to make your boat arrangements in advance.

RESEARCH BY GORDY HECK AND MARTY SYNDERMAN



ILLUSTRATIONS: DON WARREN

ANACAPA

GENERAL

Location: 18 miles southwest of Ventura and 11 miles west of Port Hveneme
Size: 1 square mile
Topography: mountainous island with seaside cliffs
Climate: temperate with 15 inches of precipitation annually
Population: one park ranger
Diving season: May-October

DIVING

Water temperature: winter 55-60, summer 65-70°F
Visibility: 30-40 feet
Depth of dives: 10-130 feet
Currents: 0-3 knots
Types of diving: kelp diving
Skill level: novice, intermediate, advanced
Dives per day: 4 unlimited, most boats carry compressors
Diving craft: excellent
Sights:
Fish: rockfish, kelpfish, ling cod, garibaldi
Invertebrates: rays, anemones, starfish, jellyfish
Restrictions: Permission to go ashore must be obtained from the Channel Islands National Monument Service, 1699 Anchors Way Dr., Ventura, CA 93003.

DIVING SERVICES

Instruction available: resort course, open-water certification, advanced open-water certification, underwater photography, through area dive stores
Equipment rental: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, BC with inflator, pressure gauge, depth gauge, compass, decompression meter, full wet suit, partial wet suit, knife, game bag, dive light, Nikonos, camera housing, underwater strobe, available from area dive stores
Equipment sales: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, BC with inflator, pressure gauge, depth gauge, compass, decompression meter, full wet suit, partial wet suit, knife, game bag, dive light, Nikonos, camera housing, underwater strobe, available from area dive stores
Equipment repair: excellent
Camera repair: excellent
Air: to 3000 psi
Guides: excellent

JUST IN CASE...

Hospitals: Los Angeles or San Diego area
Recompression facilities: Twin Harbors, Santa Catalina
Police: Coast Guard, VHF channel 16
Marine Rescue: Coast Guard monitors VHF channel 16

PLANNING

Diving tours: *Barbara Marie, Coral Sea, Jeanne, Peace, Rio Rita, Scuba Queen, Sea Bee, Sea Ventures, Toronado, Truth*



SANTA BARBARA

GENERAL

Location: 45 miles west of Long Beach
Size: 1 square mile
Topography: a hilly island with rocky coastline, seaside cliffs
Climate: temperate with 15 inches of precipitation annually
Population: uninhabited
Diving season: May-October

PLANNING

Diving tours: *Blue Sea, Golden Dubloon, Oceanus, Peace, Rio Rita, Scuba Queen, Sea Ventures, Toronado, Truth, Vaquero, Westerly*

CHANNEL ISLANDS DIVE CHARTERS

Barbara Marie Peat Moss; 3220 Peninsula, #169, Channel Is., CA 93030 (805) 985-4318
Blue Sea Dave Melson; P.O. Box 1406, San Pedro, CA 90733 (213) 833-1577
Bottom Scratcher Bill Johnston; 1403 Scott St., San Diego, CA 92106 (714) 224-4997
Coral Sea Glenn Miller; 1641 Hillcrest, Santa Barbara, CA 93103 (805) 966-1356
Golden Dubloon Eddie Tsukimura; 871 Basin St., San Pedro, CA 90731 (213) 831-5148 (213) 547-3010
Hustler Dick Howard; 2131 Shelter Is. Dr., San Diego, CA 92106 (714) 298-0531 (714) 222-0867
Jeanne Jim Herrin and Max Scuri; P.O. Box 337, Pt. Hueneme, CA 93041 (805) 488-4715
Kona Princess Dave Kane; 2803 Emerson, San Diego, CA 92106 (714) 222-1144
Mr. C Tom Lacy; P.O. Box H, South Gate, CA 90280 (213) 547-1131
Oceanus John Magilavy; P.O. Box 814, Avalon, CA 90704 (213) 510-1536
Peace Ron Palmer; 2509 E. Victoria St., Simi Valley, CA 93065 (805) 527-4577
Rio Rita Roy Kaiser; P.O. Box 4372, San Pedro, CA 90731 (213) 548-1821 (213) 832-5084
Sand Dollar Bill Johnston; 1403 Scott St., San Diego, CA 92106 (714) 224-4997
Scuba Queen Pete Greenwood; P.O. Box 867, San Pedro, CA 90733 (213) 547-2236 (213) 547-1077
Sea Bee Art Burnett; 2650 Amy Place, Pt. Hueneme, CA 93041 (805) 487-6698
Sea Ventures Jake Sunderland; 2724 Wendy Pl., Pt. Hueneme, CA 93041 (805) 486-0403 (805) 647-0167
See Vue Ira Burdine; 2442 Villa Vista Way, Orange, CA 92667 (714) 540-8001 (714) 974-4274
Toronado Ken and Roger Hess; 26302 Senator Ave., Harbor City, CA 90710 (213) 326-7460
Truth Roy Hauser and Mark Pittman; Sea Landing, Breakwater, Santa Barbara, CA 93109 (805) 962-1127
Vaquero Kent Cook; 934 Basin St., San Pedro, CA 90731 (213) 831-8198 (213) 832-8304
Westerly Jim Ingram; 141 22nd St., San Pedro, CA 90731 (213) 833-6048

Excepting the differences noted, all information listed for Anacapa applies to Santa Barbara.

Where a notation "fair," "good," or "excellent" appears after an item, such as guides or diving craft, it refers to the *availability* not the quality of the services.

Santa Catalina / San Clemente



CHARLES SEABORN

STEPHEN EARLEY

Top: Gentle Santa Catalina currents sweep the spikes of a shallow anemone. Above: A curious blue shark patrols Nine Fathom Reef off San Clemente.

Few places in the world provide the kind of diving available at Catalina and San Clemente. In these clear, ocean-blue waters visibility often exceeds 100 feet and fish life runs the gamut from spectacularly colored mini-species to great game fish. There are reefs, caves and pinnacles to explore and photograph; abalone, sea scallop and lobster for the taking in season. And when you aren't in the water, there is Avalon on Catalina, the only municipality in the Channel Islands. A deliberately quaint, tourist-oriented village, it hugs a gem-like harbor guarded by picturesque bluffs.

For California divers, these two islands are scuba mecca.

Santa Catalina, 26 miles from the Los Angeles coastline, is privately owned except for tiny Avalon. Developed as a resort and ranch in the past, most of the island is now available to the public for a variety of recreational uses. You can make arrangements to hunt deer or the deceptively dangerous wild boar. There's even a herd of buffalo roaming the outback.

As a first time visitor who plans on staying more than a day (and you should), Avalon is the place to go. There are several hotels, good restaurants and shops that are hard to ignore. Although accommodations are available all year, it is from Memorial Day to Labor Day that the place really swings. A small network of bumpy roads laces the island, but since there are only about 75 cars and trucks on the whole place, inland sightseeing is best by bus or rented jeep. Getting around town is done by walking, bicycle or little electric go-carts.

An interesting sidelight is the attitude concerning motor vehicles. Recently, the Town Council put a moratorium on bringing cars to the island. Before that, residents had to get specific permission from the Council to bring one over and, if successful in their appeal, paid a whopping price to do so. When the owner decides to ship his car back to the mainland, it's done for free but don't expect to bring it back—ever.

Gear rental and air are available at the tiny dive shop on Avalon's municipal pier. You're wiser, however, to bring your own equipment since the shop inventory is limited and during the summer season when tourist traffic is at its peak you could wind up doing more snorkeling than scuba diving.

Getting to the island is no problem. Catalina Air Lines flies amphibians to both Avalon and Twin Harbors on a regular basis and if you've never been in one, the water landings and take-offs are a thrill in themselves. Helicopters also make the run from the airline's two mainland terminals at San Pedro and Long Beach. Either way, it's a ride of less than 20 easy minutes and scuba gear is nothing new to the baggage handlers, so don't worry about a bulging dive bag.

For the more leisurely there's a two and a half hour boat ride on one of the big tourist vessels or you can sign up on any of several dive boats operating out of the Los Angeles area.

One of the prettiest dive spots on the island lies right at hand in Avalon. Head for the world-famous Casino sitting at the tip of one of the horns which embrace the harbor, don your equipment at the seawall and get wet. Instantly you are immersed in a picturesque kelp forest populated with any number of colorful fish. The bottom is rock strewn, with an interesting series of nooks and crannies gradually descending to 100 feet. In the summer, a floating mini-dive shop is moored on the spot where you can get air and emergency repairs. At 90 feet an old shipwreck makes for a little different kind of sightseeing, while up the slope lies a little cabin cruiser. The area, as you might expect, is a favorite for snorklers.

About 250 feet offshore from the power house outside Avalon is Little Farnsworth Bank. The visibility is usually excellent, making the place particularly attractive for photographers with its dramatic clefts and majestic peaks. Best diving on the Bank (and, in fact, around all of Catalina) is from September through February. The area is reachable only by boat and you'll need either a guide or a fathometer to locate its telltale peaks which crouch about 15 feet beneath the surface. From the peaks, craggy walls fall away to a depth of 200 feet. Little Farnsworth is a good place to look for yellowtail and white sea bass, sometimes even a lobster or two.

The principal drawing card, however, is the spectacular purple coral. Because purple coral is so fragile and so rare in West Coast waters, Farnsworth Bank was declared an ecological reserve by the State of California in 1973. This means look but don't touch. Three old fishing nets hang on the east high spot and another lies draped over the west's 70 foot mark creating an almost studio-like atmosphere. Watch out for the current, though, which can be a problem in this open water area.

Lying broadside to Twin Harbors is Isthmus Reef, whose



Cooperative garibaldi pose for a group portrait near Catalina's Isthmus Reef.

MARTY SNYDERMAN

rocky profile breaks the surface at low tide. Running east to west for about 250 yards, the reef is fun for divers of almost any experience. The visibility is usually fine with lots of kelp bass, sheepshead and other marine life. Colorful algae and sponges will spice up your pictures. Don't count on bugs or abalone; you'd surprise even the locals if you found any.

East of the reef, Bird Rock hunches up from the water. The seaward side of the Rock is truly exciting. A cliff-like face dropping dramatically to a sandy bottom 190 feet below, the wall is studded with algae and beautiful gorgonians. The visibility is good, sometimes reaching 130 feet. White sea bass move in from mid-April to September joining large electric rays, rock fish, the ubiquitous sheepshead and opaleye. Garabaldi are everywhere, as they are on Isthmus Reef. Once in a great while you may see the rare scythe-marked butterfly fish whose northernmost range sometimes includes Bird Rock. Early in the season, a night dive offers an excellent opportunity for sizeable lobster.

The west side is perhaps one of the better hunting grounds in the area. On the northwest, a jumble of rocks has fallen on top of large boulders, and in this talus you'll encounter some excellent bug diving. A bit farther westward will put you in the company of ling cod, mackerel, swell and horn sharks (which are the more passive of the breed), angel sharks burrowed into the sand and moray eels among the rocks. The amphitheater backdrop through which this magnificent array of sealife parades has produced some eye-popping pictures. A particularly good camera site is at the base of the rock cliff looking downward into the rocky headlands below.

A 20-mile boat ride to the west of Catalina puts you face-to-face with San Clemente. Southernmost of the Channel Islands, it has been operated by the U.S. Navy since 1934. Since World War II the south end of the island has been used as a target range and the beach is littered with spent shells, some of them live. Needless to say its one place the Navy doesn't want you beachcombing. There's an airstrip at the north end restricted to military aircraft and at Wilson's Cove, south of the airfield, is an area where Navy personnel working on missile and rocket experiments are housed.

The most popular point of departure for San Clemente is from San Diego, 65 miles to the southeast. The voyage can be a highlight of your dive trip. Outstanding among charter boats are the *Bottom Scratcher* and *Sand Dollar,* both in the 65-foot class and both operated by Bill Johnston. The *Bottom Scratcher* is named after the oldest dive club in the United States, of which Johnston is a member. Unlike some converted sportsfishers, both boats were designed for diving from the keel up. Climb aboard with your personal gear and lay back, everything else is part of the single fee. That means tanks, weight belts, backpacks and unlimited air. It's also a good idea to come aboard hungry because it's a cinch you won't get off that way. The food is outstanding, plentiful and varied. Departures are about midnight with a dawn arrival at any of Johnston's several super dive spots; the anchor comes up in late afternoon putting you at pierside in San Diego about 10 p.m. Diving begins right after breakfast and four dives a day is not uncommon. Abundant is a reasonable way to describe the game; terrific is a modest description of picture possibilities.

Pyramid Cove is a typical first stop. The deep ocean currents bathing the island make for visibility in the 100-foot-plus category affording clear view of the astonishing beauty of the perpendicular underwater cliff. In the summer, Pyramid is ideal for halibut, black sea bass, barracuda and calico bass. Green abalone populate the shallower waters.

Northward along the weather side is Seal Cove, named for the animals which live and breed there. The hundreds of resident animals are playful hosts and seem to enjoy darting among visiting divers. The picture possibilities are endless.

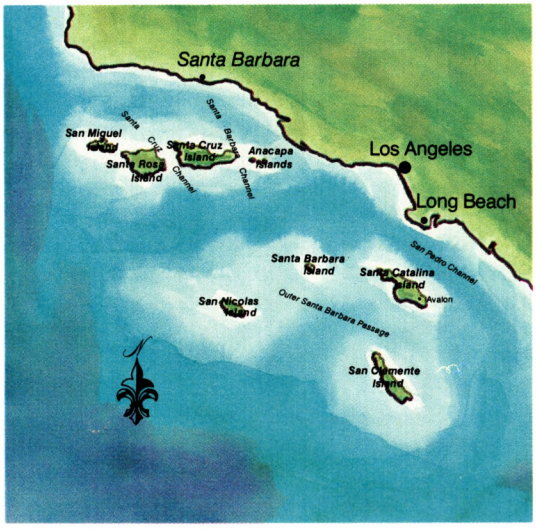
A special treat for more experienced divers is Nine Fathom Reef located a mile offshore from San Clemente's northern end. Visibility is uniformly terrific and the area abounds with fish. The reef is another good lobster location with numerous abs mixed in for good measure.

North of Pyramid Cove on the lee side you can virtually drop the hook at random and find something interesting to see. Here, too, the sheer cliffs plunge abruptly into the sea and caves are everywhere. Several plateaus, normally marked by kelp, break the shoreline. Dive boat skippers have given several of these outcroppings special names like Little Flower, Mosquito Cove and Wagon Tracks.

On this side the diving is done against the cliffs where depths drop to 150 feet within 50 feet of shore. Giant kelp colonizes the area from 20 feet of water down to about 100 feet. Like most other brown algae in the vicinity, the island kelp is usually light colored. Your interest will also be claimed by the size of the blades—some close to four feet long and nearly a foot across. This is one of the few places in the world where the entire span of a 100-foot plant can be seen all at once, which says it all where questions of visibility are concerned.

Catalina or San Clemente, it's the kind of diving you've often heard someone else rave about. Now it's your turn.

continued



ILLUSTRATIONS: DON WARREN



SANTA CATALINA

GENERAL

Location: 26 miles west of L.A. area
Size: 45 square miles
Topography: a mountainous island with seaside cliffs
Climate: temperate with 15 inches of precipitation annually
Population: 2,000 year round, 16,000 in tourist season
Largest towns: Avalon (pop. 2,000)
Languages: English
Ethnic composition: 85% Angloamerican; 10% black, 5% mixed
Economy: 100% tourism
Diving season: May-October
Tourist season: April-September

DIVING

Water temperature: winter 55-60, summer 60-72°F
Visibility: 30-40 feet
Depth of dives: 5-130 feet
Currents: 0-2 knots
Types of diving: wall, photography, collecting, lobsters & abalone spearfishing
Skill level: novice, intermediate, advanced
Dives per day: 4, unlimited, most vessels carry compressors
Diving craft: excellent
Sights:
Fish: tubesnout, rockfish, rock greenling, ling cod, sheepshead, cabezon, opaleye, garibaldi, kelpfish
Invertebrates: anemones, starfish, jelly fish, rays
Restrictions: Except for Avalon, the entire island is privately owned. Landing permits may be required. California Fish & Game license required if game is to be taken.

DIVING SERVICES

Instruction available: resort course, open-water certification, advanced open-water certification, underwater photography
Equipment rental: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, BC with inflator, pressure gauge, depth gauge, compass, decompression meter, full wet suit, partial wet suit, knife, game bag, dive light, Nikonos, camera housing, underwater strobe available through area dive stores
Equipment sales: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, BC with inflator, pressure gauge, depth gauge, compass, decompression meter, full wet suit, partial wet suit, knife, game bag, dive light, Nikonos, camera housing, underwater strobe available through area dive stores
Equipment repair: excellent
Camera repair: excellent
Air: to 3000 psi
Guides: excellent

DIVERSIONS

Ground transportation: taxi, rental car
Shopping: fair and reasonable
Restaurants: fair and reasonable
Nightlife: fair

JUST IN CASE...

Hospitals: Los Angeles or San Diego area
Recompression facilities: Twin Harbors, Santa Catalina
Police: 510-0174
Marine Rescue: Coast Guard monitors VHF channel 16

PLANNING

Diving Tours: *Blue Sea, Bottom Scratcher,* Catalina Diver's Supply, P.O. Box 126, Avalon, CA 90704, (213) 510-0330; *Golden Dubloon, Hustler, Kona Princess, Oceanus, Peace, Rio Rita, Sand Dollar, Scuba Queen, Sea Ventures, See Vue, Toronado, Truth, Vaquero, Westerly.*
On your own: Airlines—Catalina Airlines, Berth 96, San Pedro, CA (213) 510-0580; Trans-Catalina Airlines, Pebbly Beach, CA (213) 510-1000.
Airports: Pebbly Beach
Accommodations: Campo Bravo, P.O. Box 767, Avalon, CA 90704; Las Casitas (bungalows), P.O. Box 615, Avalon, CA 90704; Pavilion Lodge, P.O. Box 278, Avalon, CA 90704; Scari's, P.O. Box 127, Avalon, CA 90704. All hotels may be reached through the Avalon Chamber of Commerce (213) 831-8822.
Campgrounds: Blackjack, P.O. Box 1133, Avalon, CA 90704; Fisherman's Cove, P.O. Box 50, Avalon, CA 90704; Little Harbor, P.O. Box 1133, Avalon, CA 90704; Parsons Landing, P.O. Box 94, Avalon, CA 90704

SAN CLEMENTE

GENERAL

Location: 65 miles northwest of San Diego
Size: 55 square miles
Topography: a flat island with rocky coastline, seaside cliffs
Climate: temperate
Population: all military personnel
Largest town: Wilson's Cove
Diving season: May-October

DIVING

Water temperature: winter 50-60, summer 60-70°F
Visibility: 50-60 feet
Depth of dives: 5-130 feet
Currents: 0-5 knots
Types of diving: cave, spearfishing, kelp diving
Skill level: novice, intermediate, advanced
Dives per day: 5
Diving craft: excellent
Sights:
Fish: kelpfish, rockfish, ling cod, greenling, sheephead, garibaldi
Invertebrates: rays, starfish, invertebrates
Restrictions: The entire island is U.S. Navy property. Going ashore is prohibited. Fishing license needed if game is to be taken.

PLANNING

Diving tours: *Blue Sea, Bottom Scratcher, Golden Dubloon, Hustler, Kona Princess, Oceanus, Peace, Rio Rita, Sand Dollar, Scuba Queen, Sea Ventures, Toronado, Truth, Vaquero, Westerly*

RESEARCH BY GORDY HECK AND MARTY SYNDERMAN

Excepting the differences noted, all information listed for Catalina applies to San Clemente. For information on the diving tour operators refer to specifications on page 101 or contact a professional dive store in the area.

Where a notation "fair," "good," or "excellent" appears after an item, such as guides or diving craft, it refers to the *availability* not the quality of the services.

Santa Cruz/ Santa Rosa/ San Miguel/ San Nicolas/

If there are any great dive spots unmarred by man in southern California's offshore waters, chances are they exist near one of the Channel Islands. Specifically, San Miguel, San Nicolas, Santa Rosa or Santa Cruz. Protected by their distance from the mainland, the often heavy Santa Barbara Channel swells and private or military control, the Islands are virtually uninhabited and infrequently visited by commercial or private dive boats.

Your basic South Pacific isles they are not; no palm trees, no hotels, no big airports and only one way to get there. Taken all together, however, this may be the islands' greatest charm. When the seas are in a good mood, the islands' nearshore waters are clear, with a mid-Pacific blue that lends a special kind of beauty to every dive. Lush kelp forests form a canopy which gives the impression of diving in a vast and exotic aquarium. The species range from the small Gobi with their darting manuevers and bug eyes to the four-ton elephant seal and majestic whales. Tucked into crevices or beneath the rocks are abalone, scallop and lobster. Plant life spanning the full color spectrum are waiting at nearly every diveable level making this a splendid backdrop against which you can do some really exciting photography.

Santa Cruz is the largest of the Channel Islands stretching some 21 miles east to west and from two to seven miles wide. Deep erosional creases scar the two parallel ridges which run its length. Fresh water streams course into the long valley between the ridges nourishing the heavily wooded slopes and valley. The island is privately owned and access for recreational purposes is by permit only. There are two ranches on Santa Cruz, a landing strip and a research station operated by the University of California. Recently, a substantial chunk of the island was purchased by The Nature Conservancy which intends to maintain the land as an undisturbed reserve.

Along the ocean (or east) side are several siltstone reefs, notably at Willows Anchorage, Bowen Point, Albert and Bailey Anchorages. Generally marked by kelp, the reefs are located near the cliffs and are a focal point for fish populations.

The exposed rock off Scorpion Anchorage, northward around the point, is surrounded by another reef which juts into the sea for about 100 feet descending to the sea floor 70 feet below. The beach side of the rocks offers the best diving, especially for an early season try at lobster.

From Morse Point, about midway on the seaward side of the island, a large reef extends outward in a southeasterly direction. Several of its larger rocks are exposed, and there are shallow depths out as far as a quarter of a mile. The reef itself drops off to 50 feet on either side, and the visibility is very good except when weather from the south rears its ugly head. Morse Point is a good place to search for scallops, lobster and abalone, too.



A shy octopus lurks among cresting coral and calcareous algae off Santa Cruz.

STEPHEN EARLEY

Santa Rosa is almost as big and lies immediately west of Santa Cruz. The topography is similar to that of its neighbor to the east, supporting some sheep and cattle grazing. Santa Rosa is closed to the public but there are several good anchorages shielded by rugged outcroppings. One of these is Johnson's Lee tucked behind South Point, where a rich variety of fish live in a truly magnificent kelp forest. Large sheepshead and bocaccio can be found in the Lee as well as several kinds of rockfish, halibut and black sea bass.

Directly across the island to the north lie Beacon Reef and Carrington Point, good places to shoot film but not much in the way of spearfishing. A better bet for the meat-seeking diver is East Point where there are halibut and a fair-sized colony of lobster.

continued



Rare purple coral frames a foraging sea star on Farnsworth Bank.

MARTY SNYDERMAN

The westernmost of the islands — about 60 miles from Ventura—is San Miguel, some eight miles long and four miles wide. Standing astride the Santa Barbara Channel, it takes a lot of buffeting from the weather. Fog and strong winds are not uncommon. The 24-mile shoreline consists of sandy pocket beaches, rocky bluffs and a few sheltered coves. Small numbers of visitors are allowed ashore but only by permit and under the supervision of a National Park Service Ranger.

It's a five hour boat trip to San Miguel but once at the site, the trip seems a small price to pay. Because of its isolation, game is largely undisturbed in the waters around the island and some big ones are a real possibility. A splendid variety of animals inhabit its waters including sheepshead, blacksmith, senorita, bass, and a substantial number of rockfish.

Probably San Miguel's greatest attraction is a bridge between land and sea in the form of the pinniped. Six different kinds of seals and sea lions (pinnipeds) can be found on the island and until someone comes up with evidence to the contrary, this represents the greatest single collection of the various species anywhere in the world. More than 10,000 animals populate the Point Bennett beach area at certain times of the year! In the winter months they are joined by mating herds of elephant seal. The vicious combat of elephant seal bulls is seen by relatively few people.

Picture two four-ton behemoths reaching a height of eight feet as they rear upright on their flippers, banging, biting and gouging each other for the favor of some delightful—and probably dozing—female. It's winner take all. Their unique high barking sound of celebration, amplified by a massive overhanging proboscis, can be heard for miles.

If you are into archaeology, San Miguel offers a bonus. Numerous fossils of the dwarf or pygmy mammoth, an animal that lived about a million years ago, have been found at several locations on the island, as well as on Santa Rosa to the east. Some evidence exists that man may have lived on what is now the island, using the mammoth as a food source, 30,000 years ago. If true, then that's 17,000 years prior to the presently accepted presence of man in the southwestern United States.

At almost 70 miles from the nearest land, San Nicolas is the farthest seaward of the Channel Islands. Shaped like an acorn lying in a northwesterly-southeasterly direction, it is nine miles long and three miles wide. San Nick is owned by the U.S. Navy which maintains a missile tracking station there. The rugged southern shoreline is typified by steep cliffs averaging 500 feet in height, and there are few, if any, secure harbors. Because it is so remote, the island beckons the hardier seaman/diver with a rich and diverse assortment of marine plants and animals.

For example, nearly as many different species of seals and sea lions inhabit San Nicolas (five) as do San Miguel. In fact, the island is regarded as one of the most important breeding grounds for these animals on the West Coast.

Make the northwestern side of San Nick your first stop. Offshore lies Three Mile Reef which runs parallel to the island. Its hard, volcanic rock is gouged with deep canyons having steep 80 to 90 foot drops. Plan this for a picture-taking plunge since the depth of the dive and the exotic marine environment is something you'll want to capture on film.

At the western tip is the Boiler, an exposed rock accurately depicting its name. Visibility is usually very good, but the only reason to hunt the Boiler is for lobster or red abs. Three miles off the Boiler is Begg Rock, a must if you've made it to San Nicolas. It's a difficult area to dive because of the strong surge present most of the time and clearly not a place for beginners. The visibility, however, is terrific with reports of 150 feet on occasion. It's a splendid site for picture taking and hunters will find lots of sheepshead, ocean whitefish and a whole series of the larger rockfish. Forget it if you want abalone or lobster. The best diving is in a valley which extends from 120 feet of water to the main Begg Rock reef. The valley is walled with brittle stars, anemones and cowries together with a sizeable variety of other collectible shells.

San Nicolas first came to the attention of the European world during Bartolome Ferrer's voyage through the Channel Islands in 1543. However, neither he nor Vizcano (1602) recorded visiting the island. An educated guess would indicate it was probably inhabited by a small, ocean-oriented tribe of Indians during the 16th and 17th centuries. Certainly artifacts found at ancient village sites establish some sort of human habitation. By 1835, whatever native population was left got routed by the violent Aleuts whom the Russians had imported from Alaska as seal hunters.

Because the Channel Islands lie in a kind of marine melting pot where the colder waters of the northern reaches meet the warmer southern currents, the marine life is especially rich in the numbers of different species. Point Conception, 23 miles north of San Miguel, is considered the dividing line between northern and southern ocean communities, but this line is flexible.

For instance, San Miguel and San Nicolas Islands are surrounded by the cold water of the California Current which supports the more northern species. On the other hand, San Clemente, Santa Catalina and Santa Barbara are influenced by the California Countercurrent and host southern marine communities. And to add some spice to your diving potpourri, Anacapa, Santa Cruz and Santa Rosa Islands have mixtures of both the northern and southern forms.

In short, you can come close to seeing it all by visiting the Channel Islands.



ILLUSTRATIONS: DON WARREN



SANTA CRUZ

GENERAL

Location: 40 miles southwest of Ventura and 25 miles west of Santa Barbara Harbor
Size: 92 square miles
Topography: mountainous island with seaside cliffs
Climate: temperate with 15 inches of precipitation annually
Population: uninhabited
Diving season: May-October

DIVING

Water temperature: 50-60, summer 60-70°F
Visibility: 30-40 feet
Depth of dives: 5-130 feet
Currents: 0-2 knots
Types of diving: spearfishing, kelp diving
Skill level: novice, intermediate, advanced
Dives per day: 4
Diving craft: excellent
Sights:
Fish: kelpfish, rockfish, garibaldi, sheephead
Invertebrates: rays, starfish, anemones
Restrictions: Going ashore is prohibited; island is privately owned

DIVING SERVICES

Instruction available: resort course, open-water certification, advanced open-water certification, underwater photography, available through area dive stores
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PLANNING

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RESEARCH BY GORDY HECK AND MARTY SYNDERMAN

SANTA ROSA

GENERAL

Location: 5 miles west of Santa Cruz Is. and 30 miles west of Santa Barbara harbor
Size: 150 square miles
Topography: a mountainous island with sloping beaches, rocky coastline, seaside cliffs
Climate: temperate with 15 inches of precipitation annually
Diving season: May-October

PLANNING

Diving tours: *Peace, Rio Rita, Scuba Queen, Sea Bee, Sea Ventures, Toronado, Truth*

SAN MIGUEL

GENERAL

Location: 6 miles northwest of Santa Rosa Is. and 45 miles southwest of Santa Barbara harbor
Size: 15 square miles
Topography: a hilly island with rocky coastline
Climate: temperate with 15 inches of precipitation annually
Population: uninhabited
Diving season: May-October

PLANNING

Diving tours: *Peace, Rio Rita, Scuba Queen, Sea Bee, Sea Ventures, Toronado, Truth*

SAN NICHOLAS

GENERAL

Location: 55 miles west of Catalina Island and 65 miles southwest of L.A.
Size: 23 square miles
Topography: a hilly island with seaside cliffs
Climate: temperate with 15 inches of precipitation annually
Population: uninhabited
Diving season: May-October

PLANNING

Diving tours: *Blue Sea, Bottom Scratcher, Peace, Rio Rita, Sand Dollar, Scuba Queen, Sea Ventures, Toronado, Vaquero, Westerly*

Excepting the differences noted, all information listed for Santa Cruz applies to the other islands on this page. For information on the diving tour operators, refer to specifications on page 101 or contact a professional dive store in the area.

Where a notation "fair," "good," or "excellent" appears after an item, such as guides or diving craft, it refers to the *availability* not the quality of the services.

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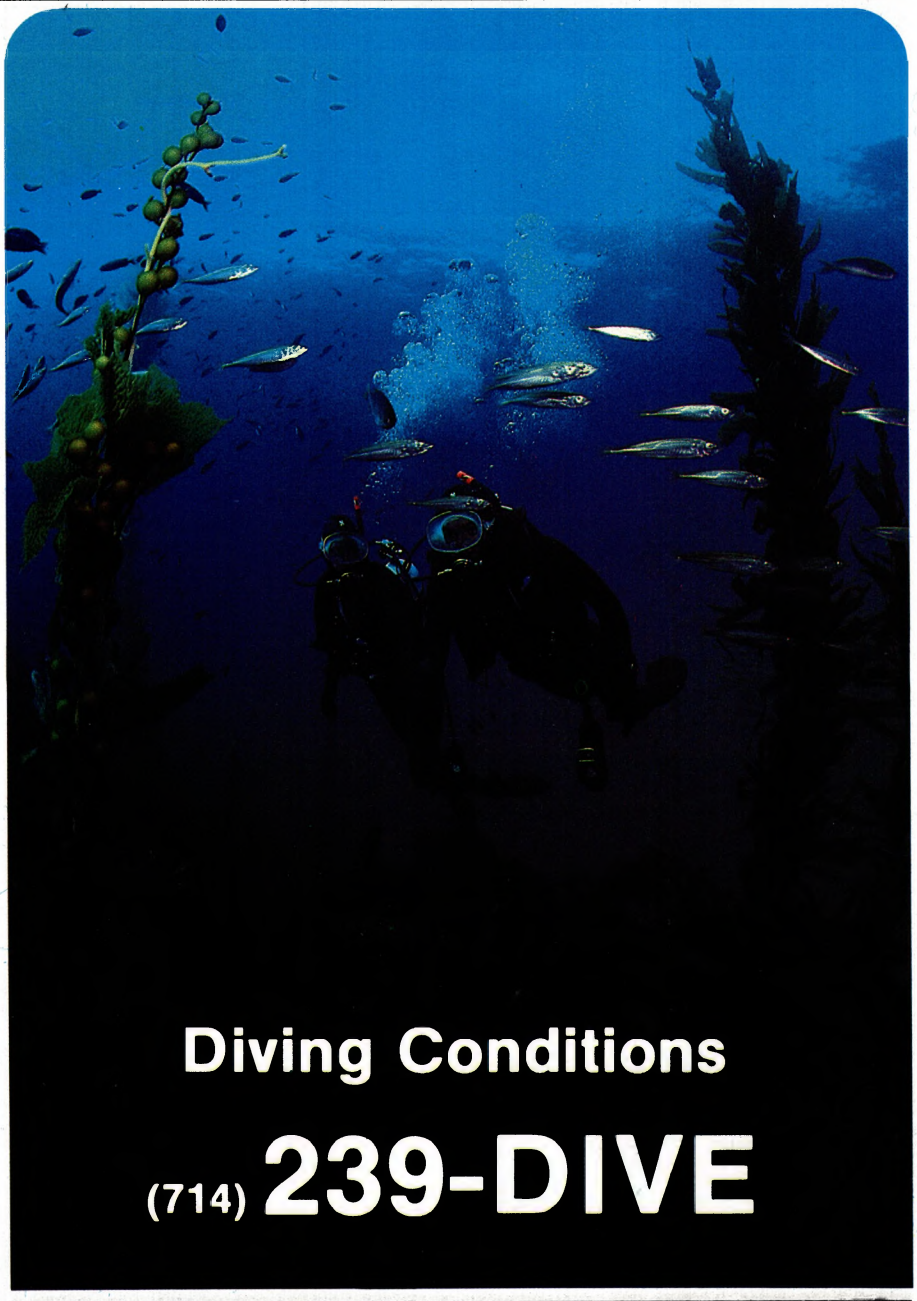
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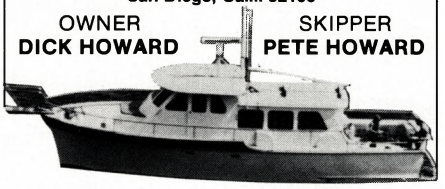
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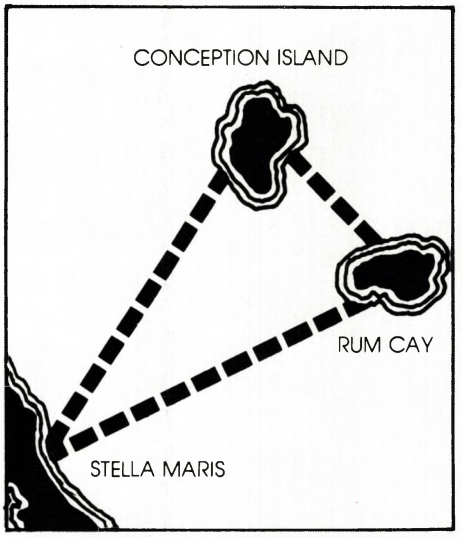
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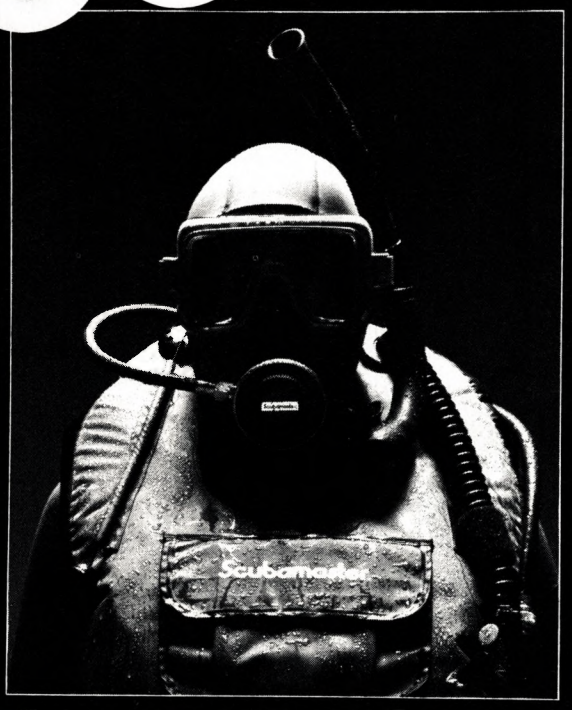
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*(Right) Leni Riefenstahl. (Below) Tubeworm, **Spirobranchus gigantius,** and a star coral, **Montastrea annularis.** Union Island, Grenadines, Caribbean.*

Profile:

Leni Riefenstahl

A film legend focuses her artist's eye on underwater photography.

BY DAVID ABRAHAMSON

Her eyes literally sparkle in conversation, as if dancing in time with her animated body-English and hand gestures. But the moods they reflect are mercurial, a melange of changing subjects, conflicting pronouncements and alternating passions. She has the face of a woman-child: open, warm, delicate, yet world-wise and weary. One moment her appearance is filled with laughter,

continued



delighting in the joy and artistry she has found beneath the sea. But just as quickly it can cloud over, caught up in the heartache of her own past, of dying reefs and of man's senseless devastation.

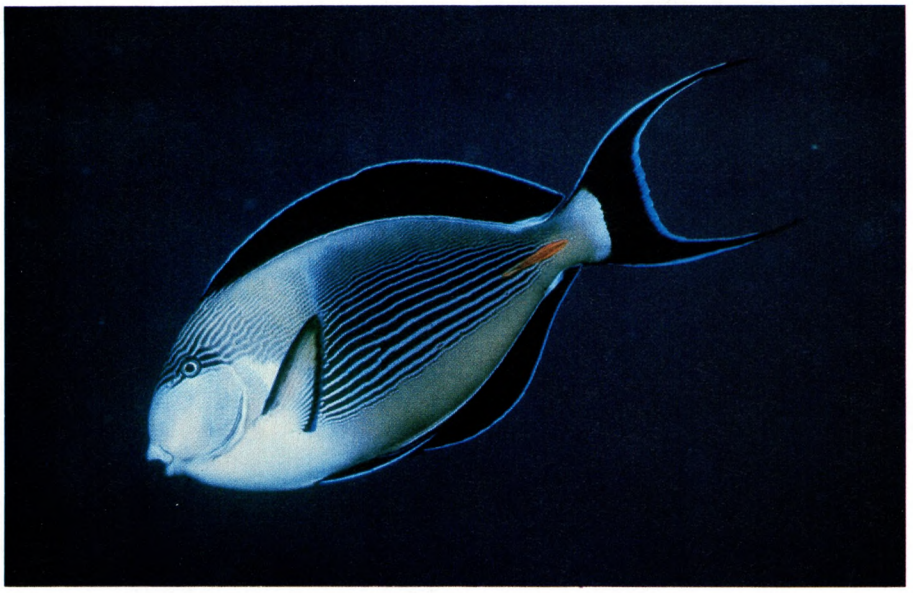
Through it all, however, Leni Riefenstahl remains a presence, an energy source. There is about her a sense of unalloyed vitality—the will to see, to feel, to transcend her own history and, most of all, to create. In word and expression, her aliveness is simply infectious. She is also, at the incredible age of 76, a very sensual woman.

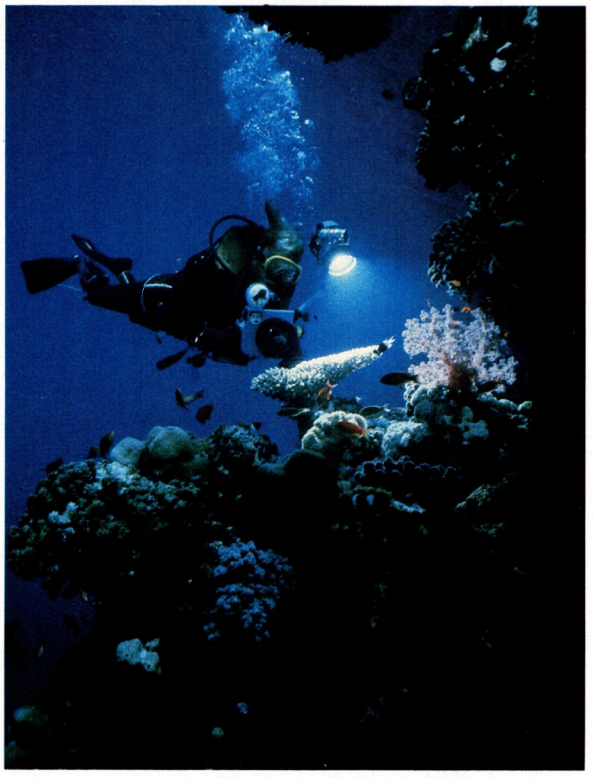
But then chronological age has never mattered greatly to her, and much of her life seems to contradict our conventional notions of what one can accomplish at what age. Acclaim first came to her in her twenties in a promising career in ballet and dance. When an accidental leg injury foreclosed her future as a dancer, she became an actress, rising to stardom in the blooming German film industry of the 1920s. Before the age of 30, however, she had formed her own movie production company and had begun directing films.

Her first success as a director was a film entitled *Blue Light*, which opened in Europe in 1932. "It played for 15 months in London and 14 months in Paris," Riefenstahl recalls, smiling at the remembrance of the work's critical and commercial reception.

Her total mastery of the art of filmmaking—the complex control of camera angles, use of lighting and attention to detail—followed shortly thereafter with two landmark films. The first was *Triumph of the Will* (1936), a documentary about the mesmerizing 1934 Nuremburg rallies staged by Adolf Hitler. The second was *Olympia* (1938), a film record of the 1936 Olympic Games in Berlin. In technical terms, both works were masterpieces, virtuoso examples of craftsmanship that even today, 40 years later, have lost little of their brilliance and impact.

But the power of the films was obvious, and Hitler's propaganda machine was quick to exploit them. They seemed perfect artistic symbols for Nazi Germany's ascendant position on the world stage, a glorification of the brazen might and willfulness of the New Order. In many people's eyes, Riefenstahl herself became the symbol of the Nazi's tyrannical world view, a high priestess in the Third Reich's hall of heroes. And once the war was lost, the world was quick to judge her as one of the criminals.





(Above) A surgeonfish, ***Acanthurus sohal,*** *(11.5") on Wingate Reef, Sudan, Red Sea. (Right) Leni Riefenstahl photographing a soft coral,* ***Dendronephthyla,*** *in Sanganeb, Sudan, Red Sea. (Facing) Beaker sponge with two gorgonians. Center, behind the sponge, is* ***Gorgonia flabellum;*** *left, the branched* ***Pseudopterogorgia.*** *North Eleuthera, Bahamas, Caribbean.*

"I had great difficulties after the war," she explains. "I was for three years in prison. Many newspapers wrote terrible stories about me, bad rumors that I had to fight. It was more interesting for the newspapers to write sensationalist things, things like 'Leni was a sweetheart of Hitler,' than to write the truth. It did not matter that I had always financed my own films with my own company, that I got not one penny from the [Nazi] party. It did not matter that the de-Nazification court in Berlin after the war ruled that even though my films were used as propaganda, they were not made as propaganda. I was involved in more than 50 court cases. It was horrible what they did to me, like in the Middle Ages."

And so for more than two decades after World War II, Leni Riefenstahl was a non-person. Unable to practice her craft, she wandered across Europe and Africa with a still camera, just barely surviving as an outcast.

It was one of her trips through Africa that held the key to her professional rebirth, for she found and photographed an obscure Sudanese tribal culture called the Nuba. The pictures caused an artistic sensation when they

David Abrahamson is a free lance writer, former managing editor of ***Car and Driver*** *and editorial consultant for* ***Sport Diver*** *Magazine.*







(Above) Tentacles of the large sea anemone, ***Stoichactis,*** *with thousands of microscopic sting cells. Turks Islands, West Indies, Caribbean. (Left) Soft or alcyonarian coral,* ***Dendronephthyla,*** *with polyps extended. Needle-like calcareous spicules can be seen on stem and branches. Shab Roumi Reef, Sudan, Red Sea.*

first appeared in a West German mass-circulation magazine in 1969. Shortly thereafter they made up the contents of two books *(The Last of the Nuba* and *People of Kau)* that *Newsweek* described as "monumentally moving" and *Time* called "dazzling." With her assignment from the London Sunday *Times* to photograph the 1972 Olympics in Munich, her professional rehabilitation was virtually complete. "Slowly, slowly is coming out more of the truth about me," she says. "Many of my enemies are not really my enemies. They just are wrongly informed about my past. It was the Nuba that changed my life. It takes a long time to get distance from the past."

It was about this time, at the tender age of 71, that Riefenstahl decided to take up scuba diving. She had discovered the joys of snorkeling the year before in the Indian Ocean, but "it was not enough. I wanted to stay longer underwater, and that would only be possible with a compressed air cylinder. But how to get hold of such a cylinder?"

Describing the experience in the introduction of her most recent book, *Coral Gardens,* Riefenstahl continues: "A week of my holiday in Kenya had already gone when I learned that there was a diving school in one of the nearby hotels. I made inquiries there about obtaining a compressed air cylinder, but it was not as simple as that. It was impossible to obtain one without a diver's certificate, and to hold such a certificate it is necessary to take a diving course lasting several days and pass all the prescribed tests. How could a woman who was past her seventy-first year take part in such a course? What diving instructor would accept and enroll so 'young' a pupil?

"But I was so keen to dive with a compressed air cylinder and be able to remain underwater a long time that I racked my brains to find a way of joining the course. So I hit on a little trick. I enrolled under my passport name of Helene Jacob and cheated on my date of birth. Instead of 1902, I put 1922 on the enrollment form. Despite taking 20 years off my age, I was easily the oldest participant. They accepted me in the course with a shrug of their shoulders and probably thought 'She'll never make it.'

"During the little celebration when the longed-for certificates were presented," she recalls, "I made myself known. When my true age emerged, there was a great shout and it was lavishly toasted."

And so she has spent the last five years diving whenever and wherever she can. "I enjoy it so much that holidays I always use for diving. The only fun I really have is diving." *Coral Gardens* is a photographic essay on the last five years, a record of that which has captured her imagination beneath the sea. "My main profession is film," she says, "but I always go with a still camera. For me, film and still photos are simply two different possibilities of art. Neither is better, and I really cannot say which I prefer. I think I am always thinking in pictures. *Coral Gardens* is only the beginning for me."

As one would expect, Leni Riefenstahl has definite opinions about the art of underwater photography, many of which are not in exact accord with conventional wisdom.

For example, on the elusive quality of photographic sharpness: "I am not one of the underwater photographers who feel it is important that the photo be sharp. Too sharp is not good. If you look at something underwater, it is not sharp. So if you make it too sharp it does not look like it is in the water. It then has no

Photography from the book *Coral Gardens* by Leni Riefenstahl. English translation copyright © 1978 by William Collins Sons & Company Limited. Reprinted by permission of Harper & Row, Publishers, Inc.

'atmosphere'. And it is important that the subject look like it is underwater."

On what makes a good picture: "You never know. I see a beautiful scene, but I never know about light and color. Something can look so good underwater, but it can end up as a bad picture. Actually, the technical aspects of photography are secondary. For me, the most important thing is to find a good motif, a good composition, and then to give it good light. Also, I think it is important to find things for subjects that are not usually photographed."

On artistic sensitivity: "This is something that is very difficult to teach. You must see the things, so it depends on the eye that you have. So many people dive and do not *see* anything. You must always *look* more, at small as well as large things. Perhaps sensitivity is something you either have or don't have. But it requires a great deal of experimentation, and the desire to develop your own style. Look at the great underwater photographers. Douglas Faulkner has his own style. Carl Roessler has his."

When asked about the relationship between the artist and what is to be portrayed, Riefenstahl pauses, searching for the right words in what is, for her, a difficult language. A quiet smile spreads across her face as she softly explains. "It is so simple: an artist must love his subject. Because you can only understand the true nature of something if you love it, if you want to see it again and again. For me, if I'm in a boat, I can't wait to be again in the water. And I'm always sorry I can't stay under longer. I am in love with the beauty. It is as if I see everything there as a fairytale, so beautiful."

Leni Riefenstahl is smiling broadly now, carried forward by the intensity of what she has seen—and the marvels of what she still hopes to find. Her woman-child eyes glitter at the remembrance.

"Yes, I am 76 now. But in every history there are people who are old who have energy. Maybe it was the rigorous training in ballet in my youth. I don't know. I have often been sick in my life, but I've always recovered. Yes, I've had many hard years, but I've never lost my strong feelings for life, for beauty, for interesting things."

She pauses again, and then concludes with a flourish:

"That is what diving means to me. There is so much to see, I have no time to be tired. You see, after all, I am only a beginner."

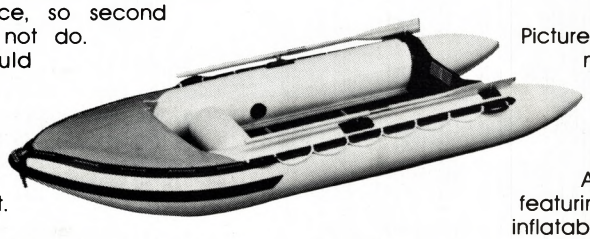
And her eyes, aglow with the possibilities, dance on.

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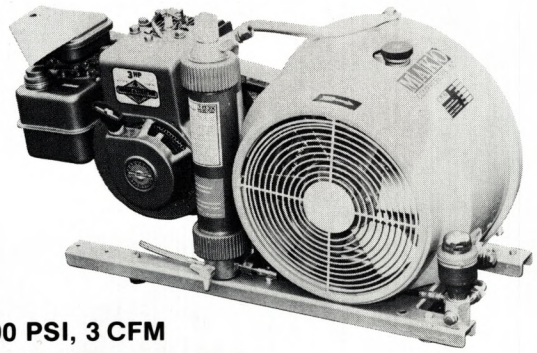
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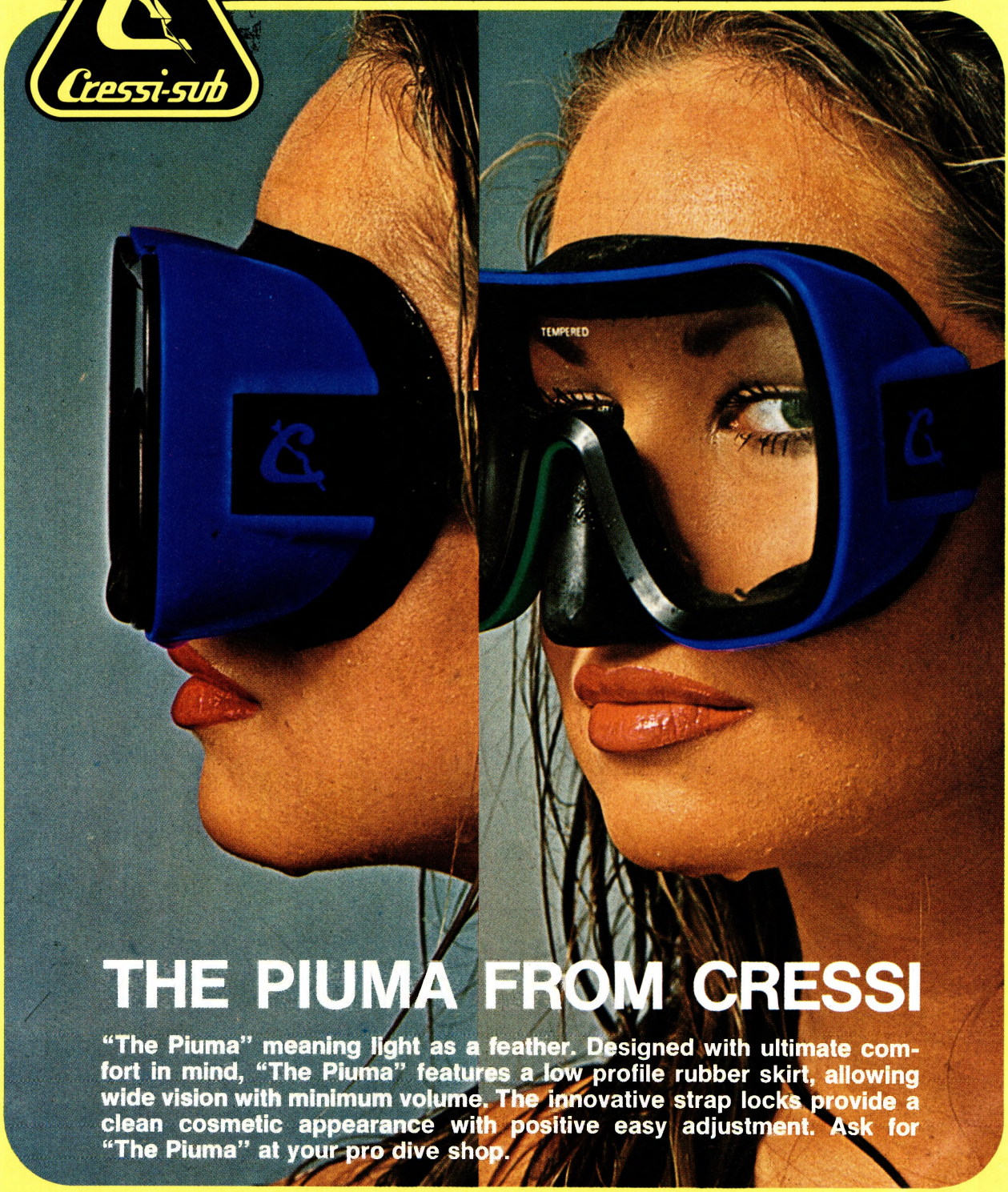


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Basic Instruction:

A Spring Tune-Up for Your Gear

Simple periodic maintenance assures you maximum return of fun on your equipment investment.

BY DAVE INMAN

Looking forward to a new year of diving, most of us spend hours comparing resort brochures or reading travel articles, figuring how to get the most fun for our diving dollar. We often neglect to spend a little time evaluating an essential part of our plans—that gear bag full of paraphernalia in the upstairs closet.

The time to find out your regulator breathes hard is not on the first dive of your vacation; it's right now while there's time to get everything operating up to specs.

Your BC

Your buoyancy compensator should be rinsed thoroughly to remove mold or mildew that may have gotten started inside. Fill the BC about two-thirds of the way with fresh water. You can do this on most models by holding open the oral inflation valve and running the water through the hose. If the water won't go down the hose, put a little air in the BC first.

After rinsing with fresh water, pour in about an ounce of BC cleaner and slosh it around. Make certain some of the cleaner reaches all parts of your BC. The cleaner will freshen up the BC bladder and will prevent growth of mold. Leaving the used cleaner inside the BC won't harm a thing.

If your BC has a CO_2 inflator, check the cartridge and replace it if you find evidence of corrosion. The firing mechanism should be checked as well to be sure the pin comes down when the cord is pulled. Lubricate the entire assembly with silicone. Using a vest checker or a spare CO_2 cartridge, test fire the inflator to insure the airways leading into the BC are open and working.

Before putting the BC away, blow in enough air to keep the inside surfaces apart. If these surfaces remain in constant contact they may stick together, causing a rip when the BC is inflated. Your BC should be rinsed after each use and always stored partially inflated.

Wet Suit

A wet suit gets a pretty good workout every time it's used, so you should examine it carefully for signs of wear. Check the seams, knees and seat for small rips. To fix tears in the rubber you'll need neoprene cement, which should be available at your dive store.



Coat both sides of the tear with cement, let it dry until tacky, then press the surfaces together and keep them under pressure for six to eight hours. A weight belt can be used to provide the pressure. Neoprene cement can affect some fabrics, especially nylon, so handle it carefully. If you do spill the cement, mineral spirits will handle the cleanup.

To protect your wet suit, give it a bath in wet suit conditioner. Add several ounces of conditioner to a tub of water, hand wash the suit and hang it up to air dry. This will keep the rubber more flexible, make it last longer and smell a whole lot better.

Lubricate the wet suit zippers with a silicone paste stick or with wax. This will prevent rust and unexpected freeze-ups.

Mask, Fins and Snorkel

Check the straps and the condition of the rubber on your mask, fins and snorkel. If they are cracked, buy replacements now. If they have dried, use silicone spray to lubricate and preserve the rubber. You should coat rubber portions of your gear with silicone regularly to keep it supple and to prevent drying.



Also consider buying a spare set of straps for your mask and fins. Nothing is more frustrating than aborting a dive because of a broken strap. Buy extras now and pack them in your gear bag.

Buckles

Check all strap buckles for proper operation, evidence of corrosion and lubricate with silicone spray or paste. Many

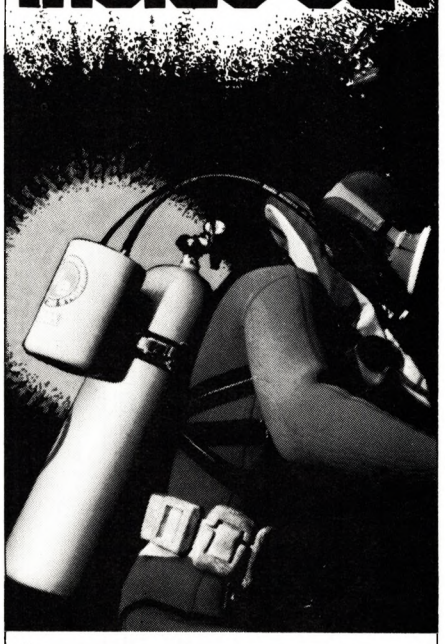


buckles have small pins that may freeze in place during storage or become loose

continued

Dave Inman is president of Divers Unlimited, a PADI five-star training facility and general repair center on the East Coast.

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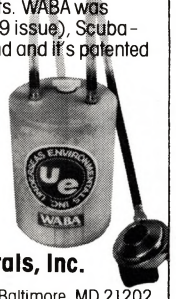


*WABA-Warm Air Breathing Apparatus

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Gear Maintenance Check List

- Wash wet suit, check for tears.
- Rinse BC with water and conditioner, check straps for proper fit.
- Check fin straps and lubricate.
- Check mask straps, lubricate and adjust.
- Check snorkel and tab, lubricate or replace.
- Take tank for hydro and/or visual inspection.
- Take regulator for cleaning, tune-up.

The national repair centers that can service your regulator by mail are:
Divers Unlimited, 4231 Hollywood Blvd., Hollywood, FL 33316.
National Scuba Repair, 16442 Gothard St., Huntington Beach, CA 92647.
Professional Scuba Repair, 5725 Cahuenga Blvd., North Hollywood, CA 91601.
Sub Aqua Specialties, 2236 Bemis Rd., Valdosta, GA 31601.

from wear. Make sure the buckle clinches firmly by closing it and yanking the straps. If it doesn't grip firmly enough, you can tighten most buckles by adjusting the metal tongue on the underside inward using something large and heavy (hammer or lead weight).

Regulator

Regulators are a little too complex for most divers to service at home, so you should have yours serviced annually by a trained technician. A total breakdown is unlikely under even the most extreme circumstances, but if the regulator is not serviced regularly, deposits and corrosion may build up on the working parts inside. As this occurs, the regulator will breathe harder, resulting in shorter dives, fatigue, hyperventilation and possible panic. You should also consider the effects of rust and salt particles that may enter your lungs from the second stage.

The cost of a thorough cleaning, testing and re-tuning of your regulator should run between $10 and $15. If parts other than O-rings or pressure seats are required, the bill could be a bit higher.

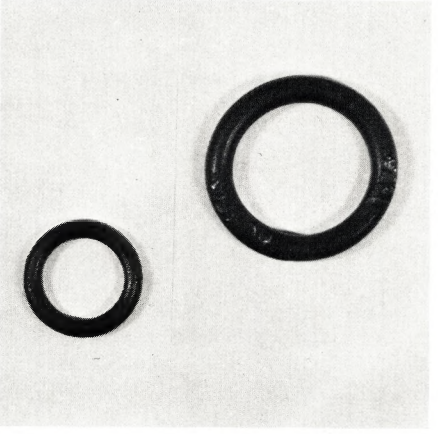
Many manufacturers will guarantee their regulators for life, provided the piece is serviced annually by a factory-certified serviceman. For a list of the authorized repair centers in your area, write the company who made your regulator. Another alternative is to use one of the national repair services who conduct their business through the mail.

Wherever your regulator ends up for service, you should be certain the facility has technicians who are factory-certified for your brand of equipment. They should totally disassemble the entire unit, not just remove the face plate. The parts should then be cleaned using an ultrasonic cleaner in conjunction with non-toxic solvents. Careful inspection of each part under magnification should follow. All defective or worn parts must be replaced with *factory specified* parts, not substitute or adapted parts. After reassembly, the regulator should be tested and re-tuned to the manufacturer's specifications.

Tanks

The tank is a vital link in your life-support system. It should be visually inspected by your dive store at least once each year, and the law says it must be hydrostatically tested once every five years. The annual visual inspection will detect surface rust and other problems that crop up between hydros. If rust does form in your tank, small chips could break off and lodge in your regulator's first stage, clogging the filter screen and impinging your air supply. Rust can also convert the air in your tank to carbon monoxide, which is unbreatheable. For this reason, the tank should never be stored with more than 100 psi. Were you to store the tank with 500 psi then have it topped off, 25 per cent of your air supply could be carbon monoxide—a deadly concentration.

While the dive store is performing visual inspection, have them remove and replace the blow-out disc in the tank valve. Each time the tank is filled, stress is put on this disc and it gets weaker. By replacing it you can prevent



Silicone: All Sprays are not Equal

Some silicone sprays are toxic; that is the propellant or carrier used in the spray can be harmful. These sprays should not be used on gear that comes in contact with the mouth, eyes or face. Don't walk into a hardware store, pick up a can of spray and have at it with your regulator, valves and mask. Non-toxic silicone is more expensive, but considering the danger, well worth the price. Before you buy the silicone *read the label* and know what you're getting.

BC conditioner is marketed by Aquidneck Enterprises, Sport Diver Manufacturing and White Stag.

Wet suit conditioner is marketed by Scubapro, Sportsways, Sport Diver Manufacturing and U.S. Cavalero.

Sticks of silicone paste are available from AquaCraft.

All of these items and neoprene cement should be available in your local dive store at a reasonable price.

a weak plug from ruining a good dive. Weak discs are particularly vulnerable in the summer when tanks may be exposed to heat which will raise the internal pressure.

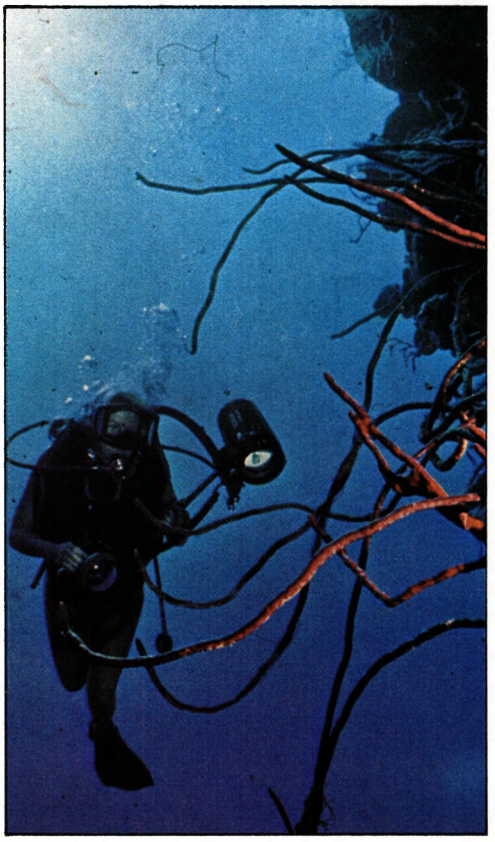
Check the O-ring on the tank valve and replace it if it appears nicked or weak. You should always carry spare O-rings for your tank valve and regulator connections.

Gear Bag

As long as you're putting everything to rights, don't forget your gear bag. Check and lubricate the zipper with silicone paste. Check the stitching on handles and straps. A thorough scrubbing with soapy water and a good airing will improve the appearance and smell of your bag.

On the whole, scuba equipment is built pretty tough. It has to function in a difficult, corrosive environment. Part of the responsibility for protecting the investment you've made in equipment is yours. Don't drag it through sand or gravel; do rinse it in fresh water after each use and store it properly. And before you go diving again, take the time to tune up your gear. The small amount of time invested will return itself in the fun of hassle-free diving.

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Advanced Instruction:

Assessing Your Mental Readiness for Diving

Even the most experienced diver may hesitate before entering the water. You should assess your psychological state and cancel the dive if you feel you aren't ready.

BY PATRICK BRAY, M.D.

For the well-adapted individual, scuba diving is a highly rewarding, even nourishing psychological experience. The appealing aspects are as intuitively certain to the enthusiast as they are darkly unfathomable to the non-diver. Yet even the most experienced diver may occasionally hesitate before entering the water. For those who dive less often, mixed feelings are not uncommon. But being less than totally eager to dive on a particular day does not make you unsuitable for diving. You should be able to assess your own psychological suitability for diving at any time and then cancel the dive if you feel you are not ready. Pre-dive anxiety can turn to panic when a diver is faced with unfamiliar or overwhelming conditions.

Unlike competitive sports, the psychology of recreational activities such as diving have received relatively little precise study. The specific factors which initially attract and sustain interest in a sport are often discussed but not clearly established by scientific methods. The advertisers of athletic equipment appear to equal the behavioral scientist in comprehending the appeal, or at least the enticing myths, which surround any leisure sport.

No doubt all forms of play have the fundamentally serious, even essential, underlying purpose of meeting basic psychological needs, such as Freud's work, love and play. One irony of our labor-saving technological age is that increasing leisure time places a burden on us to spend it in a satisfying way. Discontent in the pursuit of play may be as potentially serious as family or job difficulties. Conversely, a person matched to the right sport has achieved no small success. Ask any sport diver.

A distinction between the working and sport diver must be drawn. The environmental conditions and demands are quite different. The sport diver avoids the working diver's standard environment: dark, dirty, cold, deep water. This is not to say that working dives are always a drudgery or that sport diving is inevitably a joy. But even in the pleasant underwater conditions a diver has very different attitudes about work and play. A psychological distance exists. At work, job requirements dictate the dive. In recreation, as in leisure pursuits in general, a greater measure of control returns to the individual. At a minimum you seek to define comfortable patterns of relaxation. Beyond that, leisure activity provides a better opportunity to explore your own goals. And one goal is not to eliminate stress but to control its level to a satisfying point of excitement and accomplishment. In short, at play you decide the important business of how to give the body, mind and soul a rest—or a stretch.

As a group, sport divers may be described as young, physically active and ambitious adults who likely seek the excitement of diving for a variety of reasons. One traditional picture of a diver has been based on a macho image embellished by an aura of danger, difficulty and mystery. The undersea world is portrayed as the last frontier in the sense that only a rugged few dare enter. Before improvements in equipment, procedures and training made sport diving safer and more understandable, the classic profile of a diver was that of a physically over-aggressive, high risk-taking individual, socially fit only for the company of other divers.

This stereotype lives on, perhaps unfairly so. Even though factual data is sparse, there is agreement on certain points concerning personality structure and the sport diver. First, divers tend to have average to below-average levels of neuroticism, as measured by psychological tests. The word neurotic has acquired a meaning so general as to render it almost useless, and psychiatrists are now opting for more precise language. But for our purposes, divers may be described as less neurotic in that they are slightly less likely to suffer distressing psychological symptoms such as free-floating anxiety, obsessive thoughts and psychosomatic complaints.

continued

Dr. Patrick Bray is a psychiatrist and the senior medical officer at the Naval Diving and Salvage School in Washington, D.C.

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How to Determine Your Readiness to Dive

You are at the dive site trying to determine if this particular time and circumstance are right for you. Pay attention to your body. If your anxiety level is prohibitive of diving, your body will give some of these clues.

• Check vital signs just before exerting yourself in gearing up for the dive. If your pulse is over 90 beats per minute and/or you breathe more than 16 times per minute, then you are probably too anxious for this dive or you are physically unfit. A dangerous pattern of respiration is the feeling of not being able to take a full, deep breath; typical of high anxiety.

• You should not be sweaty, flushed or light-headed, assuming the air temperature is comfortable and you are not sick.

• Many people have a target organ which suffers concurrently with rising anxiety. Some examples are a queasy stomach, loose bowels, a tense neck or palpitating heart. If your somatic vulnerabilities declare themselves at the dive site, delay your diving.

• A certain level of pre-dive apprehension is not only common but is useful; it leads to thorough preparation. Ill-defined or unfocused anxiety is another matter. Fear not traceable to any source and which builds on itself is a warning not to dive.

Remember, do not use alchohol or other drugs to control anxiety before entering the water. Anxiety must be identified, not masked. The effect of a drug while diving may be more disabling than the anxiety.

Good divers correlate positively with intelligence, self-sufficiency and goal-orientation.

Within this profile, however, are common psychological defense mechanisms such as denial. Unless taken to extremes, any defense mechanism, including denial, is not harmful, but is a necessary means of coping. Appropriate denial is a useful psychological tool. In the water a diver does not actually deny a risk in the sense of ignoring it, but tends to minimize its anxiety-provoking aspects. The diver is able to react properly to a rapidly-changing or unfamiliar situation which might overwhelm others.

Diving appears to be attracting the more creative and intellectual personalities. Divers acquire the mobility and freedom to become natural visitors, rather than awkward intruders, into the sea. Moving weightlessly through a strange and uniquely beautiful world becomes ultimately a romantic, even primal, experience. The feelings evoked are best expressed in literature rather than psychological jargon. For example, Philippe Diolé in *The Undersea Adventure* compares diving to "the way one flies in a dream." The other-worldliness of the sea is captivating.

The diver who has optimal psychological adjustment, in addition to being physically fit, is likely to be stable, intelligent, resourceful, adventurous and imaginative. This is an ideal balance which few of us consistently attain. At best, successful divers possess most of these qualities only some of the time. And everyone has bad days—days when keen psychological self-awareness should dictate a decision *not* to dive.

If you are at times less than totally confident or comfortable as a diver, you are in the majority. The important point is that you may be psychologically suited for diving at certain times and not at others. Yet the old macho legacy sometimes prevents divers from acknowledging this reality. Significantly, the Navy has the wise policy of allowing its divers to cancel a dive if they are not psychologically ready. It is unreasonable to expect that you will always be mentally ready to dive on every occasion.

You may be psychologically suited to some undersea conditions but not to others, which introduces the concern of phobic anxiety states. One example is

claustrophobia, or anxiety caused by closed spaces. Claustrophobia may appear in a diver as a function of conditions. One may function well in clear water but experience extreme anxiety when water visibility is low. The opposite may also occur. Agoraphobia is anxiety caused by open spaces. Underwater, this is also known as the bluedome syndrome. It gives the diver an acute awareness of his isolation in water of great visibility which contains no visual contacts with people or objects. Divers hovering in deep water far from shore have reported feelings of spatial disorientation and separation.

These phobias represent extreme levels of incapacitating anxiety. Anxieties of a lesser degree are more common. One example is the reaction of divers trained in murky water who find their first experience in clear water is a surprisingly disconcerting one.

The bulk of most scuba training occurs in a swimming pool, not open water. Students who excel in the pool may be less adept in the sea and consequently discouraged and uneasy when faced with less than ideal conditions. Building broad-based confidence in diving depends on accumulating successful experiences in a variety of settings. Finding yourself uneasy about tackling a difficult new dive does not mean you are unfit for diving. You may simply not be ready for that particular type of diving experience.

Determining that you are not psychologically suited for a dive is only half the battle. Your decision not to dive runs counter to the effort, time and money spent in getting to the water's edge. Members of your dive group will probably be sending subtle or perhaps overt messages for you to go ahead and dive. If you're lucky, you may have a highly observant dive leader who advises you not to dive. More likely you will have to rely on yourself to scan your mind and body for signs of anxiety. You must first make the proper assessment of your readiness, then you must take the proper action. One alternative to cancelling might be to scale down your dive to a more manageable set of conditions.

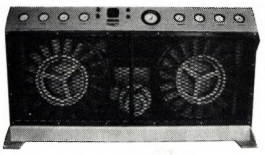
Though not recalled as a great diver, Davey Crockett had some pertinent advice: "When you know you are right, go ahead." After all, the correct decision to dive or not demonstrates a discretion essential to the continued practice of safe and enjoyable sport diving.

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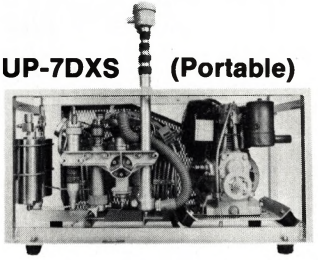
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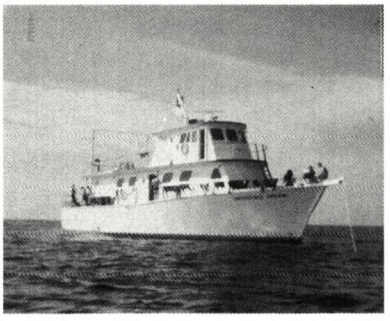
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History:

Making an Aqualung, Circa 1955

For divers in postwar England equipment was expensive, but with a few tools they could build what they needed.

BY RO SHEFFE

"It's like breathing compressed car exhaust with a mouth full of pennies."

The speaker is Christopher J. Allison. He's talking about a hazardous new sport practiced in England, 1955, by a determined band of adventurers known as sub-aquatic sportsmen. Foul-tasting air and painful copper mouthpieces were the least of their worries. State-of-the-art scuba in 1955 England meant build your own and be careful.

For the diver in postwar England, cost cutting was the only way to keep one's head below water. Rationing was still enforced, salaries depressed, equipment expensive or non-existent. Those were the times that dried men's soles. But with a few tools and a knack for scavenging, even divers of modest means could build what they needed. They used what they could get. And the awkward rigs that resulted were often more difficult to use than to build.

When an article entitled *Making an Aqualung* appeared in the January, 1955 issue of a British publication, *Newnes Practical Mechanics,* Christopher Allison was ready. The article was interesting but incomplete. Improvising when necessary and calculating by guesstimate, Allison set to work. He'd never heard of Boyle's Law, but was soon intimately familiar with Murphy's.

"Since the tiny buckles on the weight belt kept dropping weights, I discarded them and sewed the weights to the canvas harness. The thing strapped on so bloody tight it took two men to get me in, or out, of it.

"For a buckle, I riveted the two halves of a brass door hinge to the harness. Unfortunately, the hinge pin I used to fasten the thing together was steel, and rusted rather quickly. It wasn't what you'd call a quick release affair. I had a month's salary in this, and wasn't about to lose it."

Allison's tank alone cost more than a week's salary. The steel cylinder, a used oxygen container, cost seven Pound Sterling ($16.80 in 1955 dollars).

Following the article's advice, Allison removed the tank's reducing valve and soldered closed the oxygen aperture. "This is necessary," the article ex-

Ro Sheffe is assistant editor of ***Sport Diver*** *Magazine and a former editor of the Tennessee* ***Democrat.***

Making an Aqua

How to Construct Your O

By E. T. FEARON

UNDERWATER swimming is a sport which is fast growing in popularity all over the world. In this country its devotees are limited to about four months sea-swimming in each year, but the enchanting new world that is opened up—even to swimmers of only average ability—makes it a sport that is sure of a large British following. By wearing flippers and goggles alone, it is possible to view marine life clearly and at close quarters, holding the breath to dive in order to inspect anything which attracts the attention. With the simple addition of a snorkel tube one can either lie motionless on the surface of the water or move slowly along, with a gentle movement of the feet, while continuously watching the colourful panorama below.

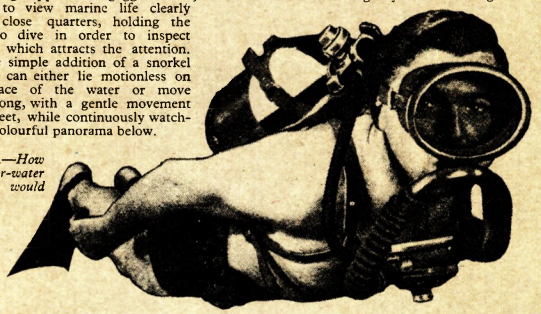


Fig. 14.—How the under-water swimmer would probably appear to the fish.

This sport is known as "skin diving"; but any skin diver will tell you that the final thrill of the sub-aquatic sportsman comes with the possession of an aqualung. "Aqualung" is the name given to the self-contained compressed-air diving apparatus which permits a trained diver to swim down to two or three hundred feet below the surface, or to explore the sea-bed in shallow waters for 40 minutes at a time. While a new aqualung might cost £40 to £70 it is possible to assemble at home a perfectly reliable piece of equipment for approximately £14. The work involved is well within the capability of the average model engineer, as will be seen from the line drawings which illustrate the modifications that have to be carried out on easily obtainable parts.

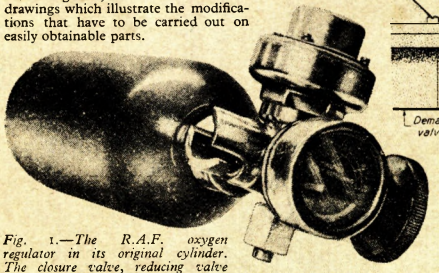


Fig. 1.—The R.A.F. oxygen regulator in its original cylinder. The closure valve, reducing valve and gauge are unscrewed as one unit and fitted into a much larger cylinder, which although capable of holding 40 cu. ft. of air weighs only 14lb.

Warning

Before going on with the details of the home-made aqualung it would be as well to point out that, simple as this equipment is, in the wrong hands, or in inexperienced hands, it could be a source of serious trouble. A cylinder explosion could be quite easily fatal, so there must be no question of using anything but a new, fully-certificated cylinder. Air jets, either at 2,000 or 20lb. per sq. in., can also cause bodily harm; they must be treated with the utmost respect and that simply means that no air must be allowed to escape.

Private pumping to recharge cylinders must not be considered, for it is a specialist's job. Empty cylinders should be sent to a depot of the British Oxygen Company Ltd., who will ensure that they are tested regularly by hydraulic pressure to practically twice the working pressure.

Before finally using the aqualung, take a course of instruction with your nearest branch of the British Sub-aqua Club. The fee will be money well spent, for you will learn not only straightforward diving, but also what to do should an emergency arise. After graduating to sea diving, always stay as close to the surface as you can swim with empty lungs, for you may have to do just that one day. And in any case never dive deeper than 60ft, nor stay there for more than 15 minutes at a time, and you need never fear the "bends."

The aqualung described here has been thoroughly tested and has been used successfully in many dives; it is believed to be a safe and trustworthy piece of equipment. However, neither the editor, author, nor publisher of this journal will be able to accept responsibility for any accidental damage to person or property arising from the use of a similar equipment.

Principle of the Aqualung

The reason there is a limit to the useful length of a snorkel tube is that water pressure increases at the rate of 15lb. per sq. in. for every 33ft. of depth. It is noticeable when "treading water" with the mouth just above the surface, that breathing requires a slight effort; if the lungs sink 2ft. farther below the surface the pressure of the surrounding water prevents them working at all. In order to counteract this effect, the aqualung is arranged automatically to adjust the pressure of the air it supplies to equal the pressure of the surrounding water. This is done by the "demand" valve, which also conserves the air in the cylinder by closing when the lungs are not taking in air.

The cylinder has a capacity of 0.4 cu.ft., and it contains 40 cu.ft. of air, compressed to a pressure of 2,000lb. per sq.in., when fully charged. This extremely high pressure has first to be reduced by a valve to about 100lb. per sq.in., and the air is then fed to the demand valve, which performs the dual function of equalising the pressure in the inlet tube to that of the surrounding water and supplying air to the lungs as soon as they start to inhale.

Conventional aqualungs terminate the inlet and exhaust tubes correctly close together, but as the complete valve gear is mounted in a single unit on top of the cylinder there is often a difference in pressure between the sensitive demand valve and the diver's mouth. In the normal horizontal swimming position this causes the air to be a little difficult to draw through, but while the diver is swimming on his back the valve is placed well below the level of his face, and causes a leakage of air through his nose and dive mask. The aqualung to be described avoids the worst of this trouble by having separate demand and reducing valves, and the demand valve is worn in the best possible compromise position, high on the diver's chest. The same conditions dictate that the inlet and exhaust tubes should terminate close together at the demand valve; if they were only a few inches apart there would be some positions of the diver in the water where the demand valve would be at a greater depth and pressure than the no-return valve in the exhaust tube, and

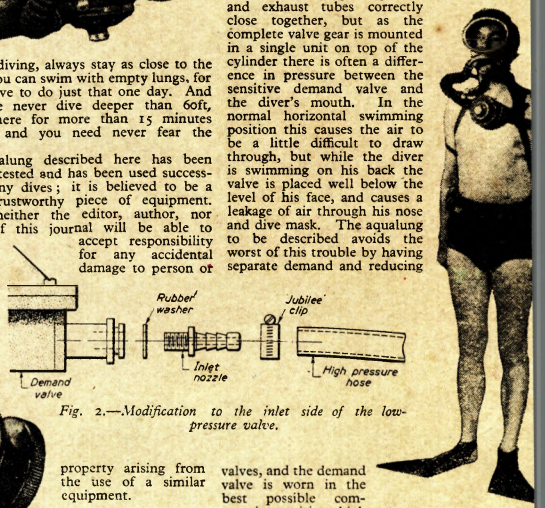


Fig. 11.—Front view of a diver wearing aqualung described.

Fig. 2.—Modification to the inlet side of the low-pressure valve.

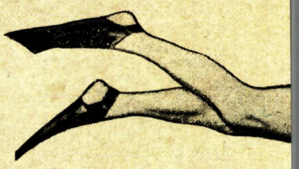


Fig. 13.—A side view of a swimme

Left: Christopher J. Allison, Lulworth Cove, 1959. Below: Christopher J. Allison, Miami, 1979.



"Lead was expensive after the war; what little hadn't been used in the war effort still existed as plumbing pipe. We certainly couldn't afford pure lead to cast our weights, but a friend of mine was a student at the Glyn School, Epsom, Surrey. He showed up one day with all the lead we needed. I understand the boys at Glyn School had to use the girls' restroom for quite some time thereafter.

"My demand valve tensioning spring came from the carburetor of a BSA Bantam motorcycle. The article in *Practical Mechanics* said to keep it well greased to prevent rust. I did, and it rusted immediately. It still worked fairly well, but the air tasted dreadful."

Two grades of air were available. Medicinal grade was too expensive. Commercial grade reeked faintly of gasoline. Sucked through a rusty regulator and a copper mouthpiece, it must have produced a taste hard to forget.

"The headaches were the worst part. And that mouthpiece. Can you imagine what a solid copper mouthpiece weighs? It's no wonder they were called 'gags'. By the time we left the water our lips and gums would be so sore we could barely talk."

Pain wasn't confined to the lips and gums. Lacking a crotch strap, the harness shifted and chafed constantly. The tank harness was attached only over the divers' shoulders, leaving it free to swing away from the body. And back again.

"I'd buckle the thing so tight I could hardly breathe, but it was no use. The tank would slip about, weights banged against my hips and thighs, and my 'chest mounted' regulator usually ended up in my left armpit. It could get quite

continued

plains, "because it would be impossible to fill the cylinder if there were a continuous leak."

Stiff wetsuits of poor grade neoprene were available for a price. Allison used tight jeans and a wool sweater. This kept him sweating in the sun and cold in the water, but it was better than nothing.

"The British Oxygen Company would bring 20 tanks, 200 cubic feet each, and stack them by the road at the top of the cliff above Lulworth Cove for weekend divers. We'd have to climb the cliff, fill our tanks and climb down again.

"It wasn't so bad on Saturday when we, and the tanks, were fresh. But by Sunday the cliff always seemed higher, and the filling tanks had lost pressure. We'd be lucky on Sunday to get 700 psi, which meant the cliff climb only earned ten or 15 minutes underwater."

To understand the value of those few minutes, it must be remembered that there are few bodies of water less hospitable than the English Channel. Water temperature in late summer sometimes reaches 40 or even 45 degrees. Currents run two to four knots. Visibility has been known to be 40 feet but is more often ten. Dead calm means three foot seas. For this, Allison and other persistent adventurers matched their ingenuity against limited assets. And their ingenuity proved as formidable as their funds were limited.

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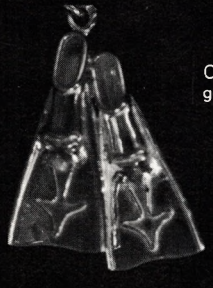
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uncomfortable when the weather was bad and the water stirred up.

"The masks and fins were made of some terrible material. Hard, cracked and smelly, they wouldn't last more than a season, and they left great creases across my face and ankles."

Practical Mechanics doesn't mention buoyancy compensators. Noting that the tank, harness and lead weights will "keep a surface swimmer quite low in the water," the article suggests carrying along a snorkel. But here Allison took the initiative.

"I found an old Royal Air Force Mae West jacket, patched it up and it seemed to work just fine. But in the water it was a different story. Inflated, the thing could squeeze the life out of you. They must have been designed to cut off all air supply. It didn't do much good to float if you couldn't breathe."

He wasn't wearing it, of course, the day his gear went down. Seas kicked up suddenly while Allison and three friends were down. Fighting four-foot waves, they made for the shore.

"It was a typical well planned dive. No BCs, none of us had a watch, and the one depth gauge we shared was so inaccurate we didn't bother reading it. We all ran out of air. Waves on the surface were quite large, and we had a hard time of it swimming in. Finally a large wave swept the tank right over my head, the hinge pin somehow fell out and the harness slipped free. It dropped like a stone. I imagine it's still at the bottom of the English Channel, growing a reef."

Allison smiles at the remembrance. His gear may have been crude, but it made bubbles. Diving was new and exotic, and Allison's home-built equipment made him a pioneer.

These days, Christopher Allison lives in a different world. As executive director of the Bahamas Out Island Promotion Board, he has access to the best equipment made. He's been spoiled by Bahamian bathwater temperatures, and he's irked when visibility is less than 120 feet. Leaning back in his chair in a plush Miami office, Allison allows that the Bahamas' crystal waters and virgin reefs may beat Lulworth Cove's murky granite shelves.

But if he'd never built that rusty rig to shiver in the English Channel for a few minutes a week, maybe he wouldn't so fully appreciate an Eleuthera weekend. It's easy to take the great things in life for granted.

Think about that the next time you can't taste your air.

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The Living Sea:

The Battle for Looe Key Reef

Organized fishing interests have delayed designation of Looe Key as a sanctuary—and may have signed the reef's death warrant.





BY ALEXANDER STONE
PHOTOGRAPHY BY
STEPHEN FRINK

There's no place like it in North America.

The convoluted ridge of brilliant coral crests near the surface, then plunges 35 feet to a winding sand-bottom gully, arching up again on the other side in a massive wall of shimmering reds and fragile blue shadows.

Delicate coral fingers with exotic names glimmer in the subdued light of a nylon mesh bag, ripped from the wall and rammed in with other rare species by a profiteer working fast. It's hard work destroying a reef. But the money is good, and the job almost done.

Two hundred years ago a hurricane sheared off Looe Key just below water level, leaving an incredible maze of shallow coral heads and yawning canyons. Commercial coral poachers and their amateur counterparts have homed in on Looe Key Reef ever since, attracted by the prospect of harvesting—or, better said, plundering—a variety of coral species unequaled in any North American shallow-water reef.

Rare tropical fish are also taken in great quantities, plucked from the water to die later in a livingroom aquarium.

Thievery of this sort is illegal of course, but poachers can afford the risk. Rare corals and tropicals bring big money, and the nearest law enforcement lies across 40 miles of choppy waters, in the John Pennekamp State Park. Poachers at Looe Key don't much worry about Pennekamp rangers, or currents, or deep, inaccessible corals.

At least 44 species of stony coral lie in clear, warm and unpatrolled water less than 35 feet from the surface. It's a poacher's paradise. But it won't be for long; stress on the reef's precarious ecological balance is increasing, and some experts believe the reef will soon be picked clean of coral species found nowhere else in North America in such accessible waters.

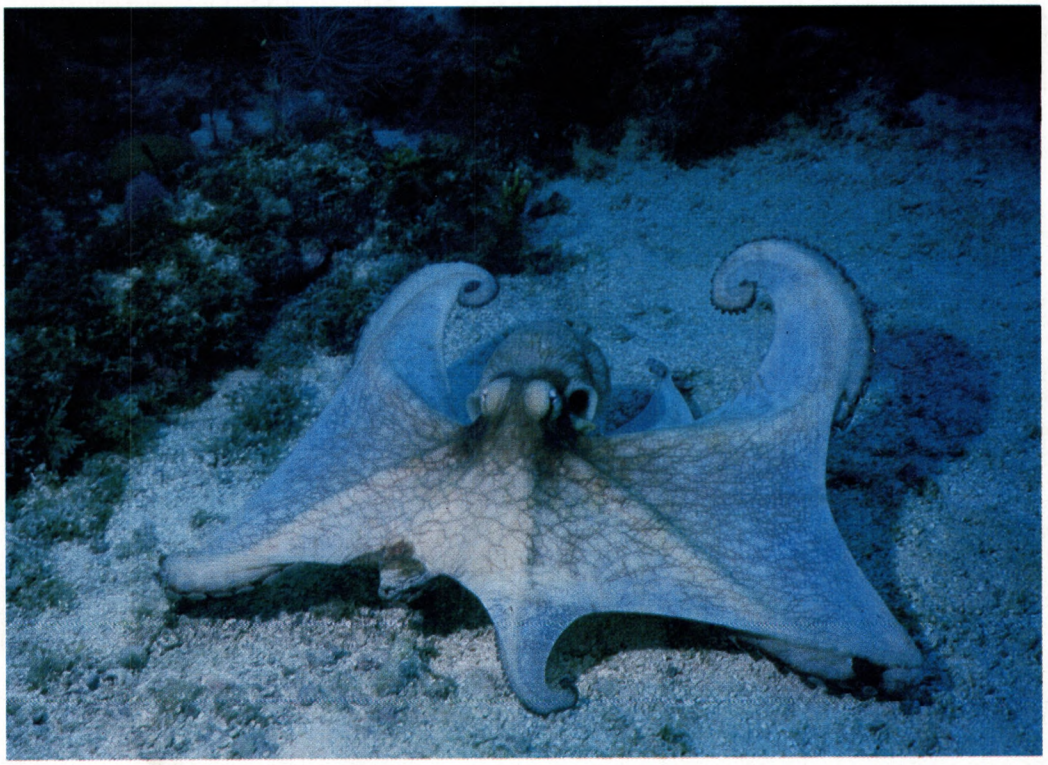
In 1976, the Florida Keys Concerned Citizens Coalition made a bid to stop the destruction by asking that Looe Key Reef be designated a protected federal Marine Sanctuary. This move, which is supported by 22 environmental groups including the Marine Wilderness Society, the Sierra Club and the Audubon Society, briefly raised hopes for the reef's preservation. Sanctuary status would provide the budget to effectively prohibit poaching, fish traps and other forms of abuse.

But optimism began to fade in January, 1978, when strong objections to the sanctuary proposal surfaced at a public hearing. Concerned about restrictions the sanctuary would place on their fishing grounds, commercial fishermen deployed the first in a series of blockades intended to stall the nomination process. Despite the fact that most fishing activities in the area are concentrated seaward of the proposed sanctuary, the proposal's progress through NOAA slowed to a standstill when the agency caught wind of a controversy.

continued

Alexander Stone is Executive Director of the Marine Wilderness Society.





Facing page, left: Looe Key Reef. This NOAA aerial photo was taken November 22, 1974 from 85,000 feet. Right: Mutilated coral is the legacy of coral poachers' pillage. Top right: No other reef in Florida has such a remarkable combination of awesome scenery and accessibility.

Above: Vulnerable reef inhabitants seek refuge in the reef's few remaining growths of finger corals. Left: An octopus scuttles along a sandy gully at the base of a coral canyon.



DON KINCAID

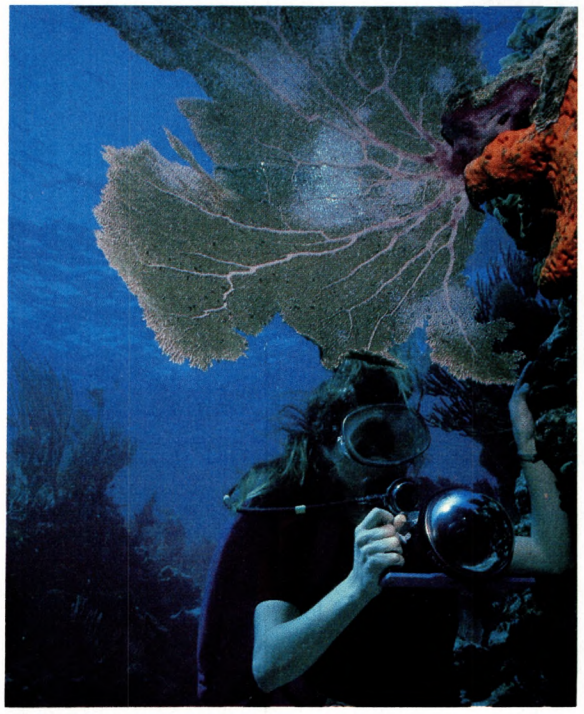


DON KINCAID





Top: Sargasso weed replenishes Looe Key's lobster and clam populations by dropping eggs laid near Mexico. Above: Green in strobe light, a colony of bioluminescent polyps glow pink in the dark. Right: Anchor damage to delicate corals is widespread throughout Looe Key. Far right: If the photographer had been one of many poachers working Looe Key, this tropical might now be cat food.





Left: Shallow coral formations and excellent visibility make Looe Key an unusually cooperative photographic subject. Below: A hogfish forages among coral outcroppings.

RICK FREHSEE

Advocates of the sanctuary were stunned. The 800 yard by 200 yard proposed sanctuary seemed far too small to cause commercial ocean fishermen much hardship, and sanctuary status would still allow traditional hook and line fishing by sport and commercial fishermen.

Less than a month later, in February, came the results of a study commissioned by the Office of Coastal Zone Management to inventory the reef. The exhaustive 63-page report catalogued an incredible array of species and warned of increasing stress and alarming consumptive destruction of sensitive species.

Still unable to decide, NOAA chose to sit on the proposal until the South Atlantic Fishery Management Council was consulted in July. Announced in April, the delay armed both sides with four months of lobbying time, and the stage was set for a major bureaucratic battle. Sharp battle lines had been drawn across the besieged reef, conservation groups on one side, commercial fishermen on the other. In the middle, undisturbed by the war of words, poachers chop apart and sell Looe Key Reef bit by bit.

By this time the critical condition of Looe Key had attracted the concern of Florida Senator Richard Stone and Congressman Dante B. Fascell. Following the announced delay in the nomination process, Fascell reemphasized the gravity of the situation, calling the proposed protection "essential...as [Looe Key is] one of the most valuable and endangered of our coral reefs."

At the center of the controversy are the determining factors that make Looe Key Reef eligible for designation as a federal sanctuary. The 1972 Marine Protection, Research and Sanctuaries Act authorizes the Secretary of Commerce to designate ocean waters as marine sanctuaries to preserve or restore their conservation, recreational, ecological or aesthetic value. Advocates of the sanctuary proposal contend that the reef qualifies for the status under at least three of the Act's criteria.

A small, unique coral system eight miles southwest of Big Pine Key in the lower Florida Keys, Looe Key is part of the only living reef in North America. It was named after *H.M.S. Looe*, a British man-of-war which grounded and broke up on the reef. But its attraction for divers is the startling array of reef species. Dr. Arthur Weiner, a marine scientist and coral reef expert, considers Looe Key Reef "one of the most diverse and biologically productive reef communities in the Florida Reef Tract."

The main part of the reef is small, only 200 by 800 yards. Within this limited area, divers can find a veritable forest of staghorn coral, elkhorn coral, flower coral and more than 40 other species, several of which are now considered endangered. No other reef so far north of the main tropical range of corals displays such diversity. The variety of corals found at Looe Key is matched by a rich population of colorful tropical fish. But it is Looe Key's unusual and spectacular coral formations that hold a special fascination for divers.

The main portion of Looe Key Reef is a high profile spur and groove system, bordering the reef in shallow water and sloping down to a sand bottom in 25 to 35 feet of water. Surrounded by colossal coral cliffs on either side, divers are awed by the magnificent canyons as they swim along winding sand-bottom gullies. Most reefs in the Lower Keys have no distinctive spur and groove system, and those that do lie in much deeper water.

Under the provisions of the Marine Sanctuaries Act, the profusion of species and unusual coral formations qualify Looe Key Reef as ecologically unique, and as an area of special aesthetic value. A strong third argument can be made for the reef's exceptional recreational value.

Nowhere else in Florida can beginning snorkelers anchor their boat on a shallow sandy reef flat, wade a short distance, swim through a channel in the reef crest, and find themselves surrounded by some of the most remarkable coral scenery in the continental United States. The sandy reef flat is what remains of the original Looe Key, a small island that was eroded below sea level by a hurricane in the late 18th century. That storm converted Looe Key's reef flat into a shallow wonderland enjoyed as a recreational area by many inexperienced swimmers and families with children. No other reef system in Florida displays such a remarkable combination of awesome scenery and accessibility.

Convinced that the evidence in favor of Looe Key Reef's nomination as a marine sanctuary was overwhelming, concerned citizens' groups and environmental organizations pressed for approval of the proposal. But in July, 1978, NOAA announced that the proposal would be delayed until the South Atlantic Fishery Management Council completed a two-year management study.

In August, the Marine Wilderness Society initiated a petition drive calling for immediate processing of the Looe Key Reef marine sanctuary nomination. Aided by the Sierra Club and the Audubon Society, the drive collected more than 4000 signatures in protest of the delay, since "a delay to await the results of a coral fishery management study ig-

continued



RICK FREHSEE

Left: Backlighted by the sun, a school of grunts darts through Looe Key shoals. Below: A diver is framed by shallow spur and groove coral formations.



BOB WARNER

nores the provisions of the Marine Sanctuaries Act that call for the establishment without delay of marine sanctuaries in areas whose high recreational, aesthetic or unique value is endangered."

Meanwhile, a concerted lobbying effort launched by concerned groups sought to persuade the South Atlantic Fishery Management Council to cancel their request for a delay.

The Council, an advisory group appointed by the Secretary of Commerce, is empowered by Federal law to manage and develop the fishery resources of the southeastern U.S. "in accordance with conservation and management principles which will yield the greatest overall benefit to the nation, with particular reference to food production and recreational opportunity."

The comprehensive biological inventory prepared by the Office of Coastal Zone Management, as it turned out, had not even been consulted by the South Atlantic Fishery Management Council before requesting their own study. A copy of the inventory was then sent to the Council, and the Audubon Society arranged for Dr. Weiner to present scientific testimony at the Council's September meeting.

But the Council remained adamant, insisting on their own survey. "The Council feels that the most effective management program would be established through the development and implementation of a comprehensive coral fisheries management program." Clearly, any proposal for protection of the reef acceptable to the Council would be one administered by the Council. And they still wanted two years to decide what to do.

While the Council was recounting fish, the Washington-based Environmental Defense Fund completed a legal study of the situation, finding little or no relationship between the Council's fishery management plan studies and the designation of Looe Key.

This and other legal opinions questioning the legality of further delay in the nomination process may mean the issue will be decided before a federal judge. But if Looe Key goes to court it's likely to be there a long time. Both advocates and opponents of the sanctuary see in Looe Key a potential precedent-setting test case for implementation of the federal marine sanctuary program throughout the United States. If the South Atlantic Fishery Management Council is successful in its attempt to halt the Looe Key nomination by calling for further studies, resource harvesting interests nationwide would be allowed near veto power over what was intended to be a preservation program.

But while lawyers rattle papers the real fate of Looe Key is being decided underwater. Each day of delay finds the coral and tropical fish populations of the reef further diminished, exploited by increasing numbers of collectors. It's an unlikely, and uncommonly beautiful battlefield. But unless an amicable solution can be found soon, there'll be no winners except the poachers.

The Marine Sanctuaries Act

Foreseeing the need to protect fragile ocean ecosystems, in 1972 Congress enacted the Marine Protection, Research, and Sanctuaries Act, or P.L. 95-532. In part, the Act says: "The Secretary of Commerce...may designate as Marine Sanctuaries those areas of the ocean waters, as far seaward as the outer edge of the Continental Shelf...which he determines necessary for the purpose of preserving or restoring such areas for their conservation, recreational, ecological, or esthetic values."

Through the Secretary of Commerce, the responsibility for pinpointing sites was delegated to the National Oceanic and Atmospheric Administration (NOAA) and its Office of Coastal Zone Management.

In 1977 the Office issued a general call asking that interested parties suggest specific sites.

To date, over 100 suggestions have been received. Of these, only two have been nominated, designated and confirmed: the area around the *USS Monitor* off North Carolina, and an area seaward of and adjacent to John Pennekamp State Park in Key Largo, Florida. Of the remaining nominations, only five are being actively pursued by NOAA.

The Conflict

The Looe Key nomination is considered a keystone by environmentalists. They feel that if fishermen block the Looe Key site, a dangerous precedent will be set that jeopardizes the entire marine sanctuaries program.

Most observers agree that Looe Key is a model site for sanctuary status. Dr. Arthur Weiner, a marine biologist who has lived near Looe Key for a number of years, believes the quality of the reef has diminished appreciably: "Although we didn't have an actual data base prior to the recent Looe Key Biological Inventory, it is my professional opinion that Looe Key has suffered a broad spectrum of decrease in species populations. Certain fin fish and invertebrates have suffered pronounced declines...particularly groupers, snappers, and the smaller, more attractive corals."

Weiner feels sanctuary designation is the only presently available solution which could halt degradation of the reef's resources. "The impact which Looe Key Reef is sustaining is progressive and getting worse. If the reef is not protected by a sanctuary designation, I believe that the species populations now under stress will be either reduced drastically or extirpated," Weiner said. "And once that happens, the stress will simply shift to other species on Looe Key." In scientific terminology, to extirpate a species means to make it extinct within a geographic area—in this case, Looe Key Reef.

Executive Director of the Organized Fishermen of Florida (OFF), Jerry Sansom, explained his group's position this way: "We are against the prohibition of commercial fishing activities on Looe Key Reef if they are prohibited just because it is designated as a sanctuary and not because the activities themselves have been proven harmful. We also have considerable problems regarding who is going to define and delineate the buffer zone between the main part of the sanctuary and the area outside."

Defending the position of the South Atlantic Fisheries Council, which requested NOAA delay consideration of the Looe Key nomination, Executive Director Ernest Premetz said, "Fears that Council plans will not address the decimation of fish populations or the alleviation of the negative pressures now being suffered by the entire ecosystem are unfounded. The Fishery Conservation and Management Act specifically directs the Councils to consider such matters in the development of management plans."

Another problem seems to be one of dialogue between the opposing groups. While environmentalists say they are asking for an 800 yard by 200 yard sanctuary, the fishermen complain they have heard a different—and much larger size—proposed; something like 20 square miles. JoAnn Chandler, Acting Director of the Sanctuary Programs Office at NOAA said that no specific size has been decided on at this point, and that she too has heard conflicting reports of the size area for which protection is being sought.

Florida Congressman Dante Fascell has taken a personal interest in the Looe Key affair, and agrees that protection for the area is essential. He observed that, "...one of the reasons that further consideration of the Looe Key nomination was suspended was the considerable opposition expressed by the commercial fishing industry."

Under the terms of the Marine Sanctuaries Act, NOAA must consult with interested federal agencies and the public: "The Secretary shall hold public hearings in the coastal areas which would be most directly affected ...for the purpose of receiving and giving proper consideration to the views of any interested party."

In addition, a proposed amendment to the regulations governing administration of the Act would require consideration of "The economic safety and other effects of displacing certain human activities..."

These activities would have to include fishing—the primary ocean-related economic activity in the Florida Keys.

Before a sanctuary designation can be made, conflicting uses of an area must be brought into sharp focus so that the Sanctuary Programs Office can make a reasonable judgement according to the criteria established in the Act.

Acting Director Chandler said that, though her office expects opposition from resource users regarding all sanctuary site candidates, the existence of a specific plan spelling out coordinates of the site, area in square miles, present and prospective uses of the site and detailed description of the resources there before public hearings are held can greatly speed resolution of such conflicts.

Comments on the Marine Sanctuaries Program and on the nomination of Looe Key can be directed to:

JoAnn Chandler
Acting Director, Sanctuary Programs Office
NOAA
3300 Whitehaven Street, NW
Washington, D.C. 20235

Marine Wilderness Society
P.O. Box 943
Miami, FL 33165

Sea Technology:

Offshore Nuclear Reactors– The Power and the Poison



Placing nuclear power plants in the ocean sounds like an innovative energy alternative—but there are grave questions of safety yet to be answered.

BY RO SHEFFE

It will be the single most expensive piece of equipment ever to roll off an assembly line. The assembly line itself will be the world's largest. Nine-hundred-ton components will be dropped into place by a gantry crane that could straddle the U.S. Capitol and pass over its dome. The finished product will float, weigh 320 million pounds and cost about $3 per pound. It will produce enough electricity to run a city of 600,000 and contain enough radioactive material to "contaminate thousands of cubic miles of ocean."

They are called floating nuclear power plants, and the people who want to build them are accustomed to dealing in superlatives. For the past seven years, Offshore Power Systems, a subsidiary of Westinghouse, has been seeking licensing to mass produce something the world has never seen. Floating on barges about 400 feet square and projecting 177 feet above the waterline, the floating nuclear plants ("FNP") will be towed to offshore or estuarine sites on the Atlantic and Gulf coasts.

Concerned opponents cite their own superlatives. MIT physicist Henry W. Kendall told a Congressional committee a single accident from a floating nuke could produce "a catastrophe of a kind the country has never experienced." Ralph Lapp, a nuclear physicist who assisted in the development of the first atomic bomb, considers nuclear plants "a potential threat without precedent."

Not since the napalm controversy have emotional reactions to a technological project run so high. Respected scientific authorities are split sharply in their opinions, some hopeful, some horrified. Endless rounds of congressional hearings and research efforts have produced tons of printed reports, many more questions and no conclusive answers. Of one such report, an investigator told the Nuclear Regulatory Commission in February, "Anyone who has tried to work with it comes away drinking heavily."

OPS plans to build floating nukes, or "flukes," in a graving dock similar to a shipbuilding facility in Jacksonville, Florida. From there they will be towed, usually two at a time, to sites in estuaries or up to three miles offshore to float inside a breakwater reaching 40 to 70 feet to the sea bed and protruding 55 feet above the surface. Covered with thousands of 62-ton concrete dolos to dissipate wave action, the manmade atoll must be able to protect the twin plants from a 200-mph hurricane and the impact of a large ship traveling at 16 knots. Inside each dome-shaped reactor, intense heat produced by a chain reaction of splitting atomic nuclei vaporizes water to produce steam. Compressed to a pressure of 15 million psi, the steam drives a high-speed turbine which in turn powers a generator.

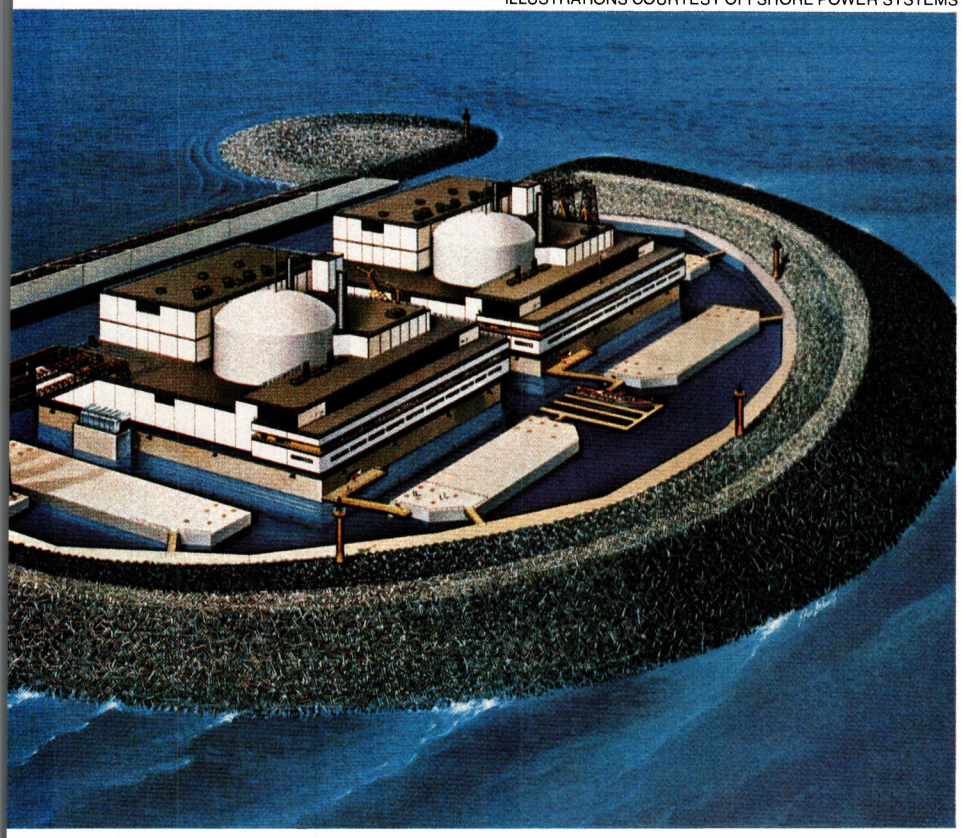
The plant will suck 2300 cubic feet of water per second, run it through 87,500 feet of copper pipe to cool the 4000-degree reactor core and dump it back into the ocean 16 degrees warmer and bearing trace amounts of copper ions, radionuclides, chlorine and other biocides. OPS says the plant's thermal plume and effluents, through dilution in the open ocean, will be reduced "to a level believed safe for aquatic organisms."

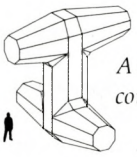
The availability of unlimited amounts of seawater as coolant makes ocean siting an attractive option. But some who look closer at the prospect don't like what they see. Herbert L. Windom, an associate professor at Georgia's Skidaway Institute of Oceanography, is one.

Assuming a fluke will use about one per cent of the total volume of water in an area 30 miles by 60 miles by 100 feet deep each day, Windom calculates each floating nuclear plant would increase the tiny amount of copper in that water by ten times. After 100 days of operation, the plant would increase the copper content in the total volume of water by ten per cent. How much copper would enter the food chain and what level of risk it poses remain unanswered questions.

Documents prepared by OPS assume a certain amount of radiation will be absorbed by persons living nearby.

ILLUSTRATIONS COURTESY OFFSHORE POWER SYSTEMS





A 62-ton concrete dolo.

Left: An artist's rendition of Offshore Power Systems' proposed floating nuclear installation off the New Jersey coast.

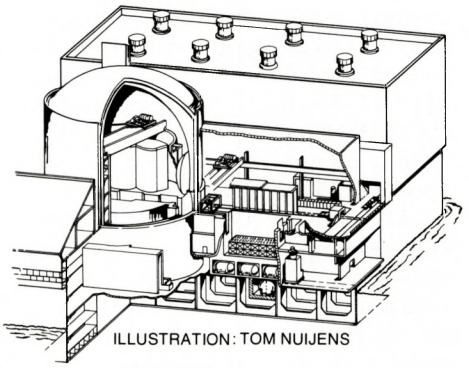


ILLUSTRATION: TOM NUIJENS

Above: Cutaway view of the nuclear fuel building showing the dome-shaped reactor containment vessel.

"External radiation exposure of the whole body and exposure of internal organs by inhalation of low-level airborne activity could occur to that segment of the public located downwind of the FNP."

After extensive study over a period of years, the Nuclear Regulatory Commission decided such radiation exposure to persons within 50 miles of a floating nuke is below NRC maximum permissible levels. Commercial and charter boat operators in the plant vicinity, according to the NRC, would receive "a direct annual radiation dose from an offshore FNP" of an amount which "would not be expected to produce any observable effects." But testimony presented to a House Government Operations committee in 1976 concludes "Health effects from radioactive sources are cumulative...any level of radiation exposure is harmful."

To place these risks in perspective, OPS compares them to health effects attributable to power production by other forms of energy. This is difficult to do since radioactive effects are very hard to quantify, but OPS maintains effluents from its nuclear plants would pose less risk than those from oil, gas or coal burning plants.

Research tends to support this assumption, but many observers feel that is only because of factors omitted. Through a process of biomagnification, radionuclides absorbed by plankton from seawater are accumulated and passed through several trophic levels of a food web to predators. Predators eating large amounts of plankton concentrate this radiation, passing it along to larger predators in larger amounts. By the time a game fish reaches the dinner table, the originally tiny amount of radiation absorbed by plankton has been increased as much as 50,000 times.

In the same way, airborne releases bioaccumulate, increasing radiation levels by passing from feed grains to livestock. Studies of a species of buffalo native to Taiwan, where a nuclear reactor has operated for a number of years, indicate the radioactive content of the buffalo's rib bone triples between the ages of one and five years. Measurable amounts of radiation were found near the reactor in sampled soil, drinking water, tea leaves, milk, fish, chickens and ducks.

Studies such as these have been performed only on land-based plants. In an attempt to gain a better look at the real risks posed by a floating nuke, the Nuclear Regulatory Commission in 1975 began to assemble research and testimony for a series of reports released over a period of three years. The resulting foot-high stack of reports represented the most comprehensive examination of the floating nuke concept ever assembled, and was loudly criticized by both the nuclear industry and concerned nuclear opponents.

Parts of the Final Environmental Statement could make a biologist cringe. "Entrainment and impingement (being sucked up and killed by the plant's coolant water intakes)...may deplete the populations of various marine biota in the vicinity of the offshore station... schooling bait fish, jellyfish and pelagic crustaceans are likely to be impinged in the greatest numbers."

Dredging, necessary for the initial installation of all floating nukes and which must continue indefinitely for some, will stir up bottom sediments which may have accumulated substantial amounts of mercury, DDT and industrial toxins. This "could result in potentially harmful doses of heavy metals by way of direct exposure to dissolved mercury, or ingestion of mercury concentrated through the food chain. Particles such as DDT are bioaccumulated when resuspended sediments are ingested by filter feeders" (species which filter water for food). Dredging for each plant would disturb about 550 acres, destroying seagrasses and marshes important as processors of manmade wastes.

Over the objections of the Environmental Protection Agency and the National Oceanic and Atmospheric Administration, NRC decided such environmental effects due to normal ope-

continued

rating conditions were acceptable.

But what if something were to go wrong, badly wrong? Like other industries, the nuclear power industry is plagued by occasional accidents due to human error or equipment malfunction. The difference is that nuclear fuel, unlike coal or oil, is deadly and remains so for many thousands of years. One by-product of any nuclear reaction, plutonium, is the most toxic substance known to man. The physicist who discovered plutonium, Glenn T. Seaborg, called it "fiendishly toxic" and named it after the Greek god of the dead. Plutonium retains its killing power for more than 250,000 years.

The pressurized-water reactors OPS will use pump steam and high-pressure coolant throughout the plant. If coolant were lost due to a rupture anywhere in the system, highly pressurized water would flash into steam and escape at a tremendous rate, leaving the reactor core without coolant. Nuclear engineers refer to this event as a "blow-down." What happens next they prefer not to discuss.

Nuclear fuel left without coolant for as little as 45 seconds in a pressurized-water reactor becomes so hot that restoring water does more harm than good. At these extreme temperatures, water chemically reacts with zirconium cladding on the nuclear fuel rods, raising temperatures even higher. By this time, the molten core has begun to melt through its containment building, releasing intensely radioactive steam and gases generated as concrete and steel are vaporized. There is very little that can be done at this point except mass evacuation. This is known as a meltdown, and it has never happened. More than once it almost has.

After a period of days, the molten core of a land-based reactor would reach bedrock, diminishing its intensity enough to permit "interdictive measures" by disaster teams. But the difference here between a land-based meltdown and a similar accident on a floating nuke is so critical it has been the controversial subject of two 400-page reports by NRC. The Liquid Pathway Generic Study and the Final Environmental Statement, Part Three, were released in February and December, 1978. The reports analyze possible consequences of a floating nuke meltdown accident. Both conclude that nothing can be done to stop such an accident once it has begun.

Between one and four hours after loss of coolant, the reactor vessel and barge hull will have melted through, dropping 150 tons of intensely radioactive molten reactor fuel into open ocean beneath the plant. When the molten mass hits cold water, a violent steam explosion will result. Its intensity can only be guessed. The explosion will cause "serious damage" to the adjacent twin plant, possibly causing it to also lose coolant and melt down.

Thick clouds of highly radioactive steam boiling up from the accident site will extend 25 miles or more, covering an area within a 45-degree sector centered on the direction the wind is blowing.

"Long term relocation of affected populations" would begin immediately.

Access to evacuated areas would be restricted for several years, "during which time substitute housing, employment, food and supplies would be required until the relocated population stabilizes in their [sic] new environment.

Depending on the plant site, between 30 and 200 miles of shoreline would be directly contaminated.

All crops and milk supplies would be impounded and destroyed.

"Fishing restrictions could be in effect over a 300 square mile area and could extend up to 100 years."

A 1965 study supressed by the Atomic Energy Commission for eight years estimates the consequences of a major nuclear disaster on land to be 45,000 deaths, 100,000 injuries, property damage of 17 to 280 billion dollars and long-term contamination of an area the size of Pennsylvania. OPS says a floating nuke would be safer than a land based plant. But the NRC is not so sure, and after years of research is beginning to call into question the conservatism of some safety reports.

Until February of this year OPS argued, and the NRC agreed, that the probability of a meltdown accident was small, about one in 20,000, give or take 16,000. But in February the NRC repudiated the one in 20,000 probability, charging that the study which produced it had been calculated "with a degree of arbitrariness [that] boggles the mind." The new report doesn't provide a meltdown probability, stating only that the previously calculated margin of error of 16,000 is "understated; we can't say by how much."

The nuclear industry is proud of its safety record. Considering the incredible potential for danger and the large number of times disaster has been averted by sheer luck, the fact that there have been only seven deaths in the U.S. from radiation is remarkable. But large accidents can result from small blunders, and the stakes are growing larger.

Top-level NRC memos recently released by the Union of Concerned Scientists (UCS) provide poignant reminders of the one probability variable which defies accurate prediction—simple human folly. Dr. Stephen Hanauer, a senior NRC official, has kept a private file of serious accidents and safety failures at U.S. plants for the last ten years. When word of what he called his "nugget file" reached UCS, Hanauer was forced to disclose the memos.

In California, a wrong switch was pulled; subsequent short-circuiting caused a complete loss of off-site power, all safety systems and 3500 gallons of reactor water.

In New York, earthquake-proof switches were "accidentally bumped," causing generator shutdown, loss of reactor water, and activation of emergency safety systems which then malfunctioned.

In Virginia, emergency core cooling pumps failed to start because "fuses were not installed."

Shielding water protecting personnel from radioactive spent fuel was lost at an unidentified plant "due to basketball failure." Used as a makeshift plug in a large-diameter pipe, the basketball "failed," spilling 14,000 gallons of water into the basement.

At another reactor site, radioactive drinking water was caused by a hose connecting the drinking water system with a 3000 gallon tank of radioactive waste. This note concluded, "The coupling of a contaminated system with a potable water system is considered poor practice in general..."

The list is long. Accidents will occur. One senior engineer who resigned from OPS in 1976 is sure of it. Ernst J. Effenberger, a mechanical engineer with 30 years experience, believes the risks of a nuclear plant would be enhanced greatly in any floating design. "I believe the design and arrangement are made against any good engineering principle, judgement and experience."

In testimony before the Atomic Safety and Licensing Board, Effenberger said there is risk that the turbine generator could "go to destructive overspeed." This could send projectiles with

such force they could "penetrate all the structures, the shield building, the containment and the reactor vessel itself, and in addition would puncture the hull and sink the plant." Effenberger has a long list of design oversights. OPS says all of Effenberger's contentions have been resolved.

Less certain than ever is the question of risk. Just how likely is a major meltdown accident involving mass evacuations and what the NRC calls "acute fatalities"? Even the NRC now refuses to hazard a guess. As a stopgap, NRC has told OPS it must design a "sacrificial bed" of magnesium oxide harklase brick below the reactor core. A four-foot thick slab of this ultra-hard material would allow an extra 55 hours of evacuation time before a molten core explodes into seawater. OPS formally protested the NRC's legal grounds for requiring what they call a "core catcher." But watching projected costs of production rise with each new delay in the licensing process, OPS reluctantly agreed to comply in mid-February.

They may not have time. In December the last two orders for floating nuclear plants, of an original eight, were cancelled. Public Service Electric and Gas Company of New Jersey finally backed out because delays in licensing and controversial questions of safety were making the nuclear option more expensive and less certain each day. Environmentalist Barry Commoner and others believe that in the 1980s, possibly by 1981, nuclear electricity costs will surpass the cost of coal-generated power.

Already making itself felt in the nuclear power marketplace is an international price-fixing cartel similar to the Organization of Petroleum Exporting Countries (OPEC). Gulf Oil Corporation, through its board chairman, admitted in 1977 under questioning by a House Interstate and Foreign Commerce subcommittee that the cartel with which Gulf cooperated had brought about an increase in the world price of uranium. The uranium marketing cartel was formed in 1972 with the stated purpose of forcing an increase in the world price of uranium. NRC estimates U.S. known and projected reserves of uranium amount to no more than a 30 year supply at present levels of usage.

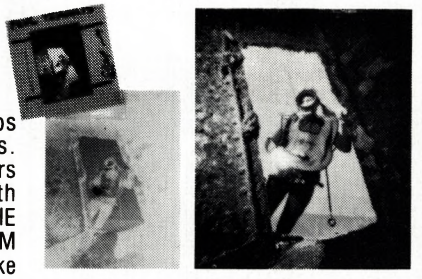
Ironically, the useful lifespan of a nuclear power plant is also about 30 years. After this period the reactor must be decommissioned, a project which could cost almost as much as initial

continued

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construction. Saturated with accumulated radiation, the plant must be either sealed impenetrably and guarded for hundreds of years to prevent radioactive releases to the environment, or cut up, hauled away and buried in deep salt deposits. Some forms of radiation are extremely long lived; a recently discovered isotope, nickel-59, transforms steel in the reactor building into a deadly substance that will emit hazardous levels of radiation for more than 500,000 years.

What can be done with a hot 320 million pound structure which will emit deadly radioactivity for half a million years? So far, the only reactors to be decommissioned have been small experimental models, only a fraction of the size of a modern plant. Even such tiny reactors present unique problems. The structure itself is so radioactive that a man trying to work inside the reactor building would burn to death in seconds. The plant must be cut up by remote control underwater, trucked away in lead-shielded containers and buried. Water used for protection during demolition, 10,000 to 50,000 gallons, must be evaporated to remove radioactive particles. Even the crane used to cut up the plant must be chopped into small pieces and buried. The entire operation is so dangerous that a lifesized replica of the plant must first be built and cut apart underwater as a rehearsal.

Reactors such as those OPS proposes to build for FNPs are about 100 times the size of small plants now being decommissioned. The sheer bulk and immense levels of radioactivity in a reactor this size are such that the technology to take one apart doesn't yet exist.

In February a senior OPS marketing executive privately admitted OPS suggests prospective buyers sell the worn out flukes to countries in need of cheap power where no nuclear safety laws exist. In the U.S. alone more than 175 threats of violence against nuclear reactors have been reported since 1969. The potential for terrorism in many countries is much greater.

Final hearings conducted by the NRC in March may lead to a go-ahead for FNPs. By July OPS could have a license to build flukes. OPS says its facility can produce four per year. At this point no one knows how cost-effective, how environmentally significant, how safe or how dangerous they will be.

We may find out soon—perhaps too soon.

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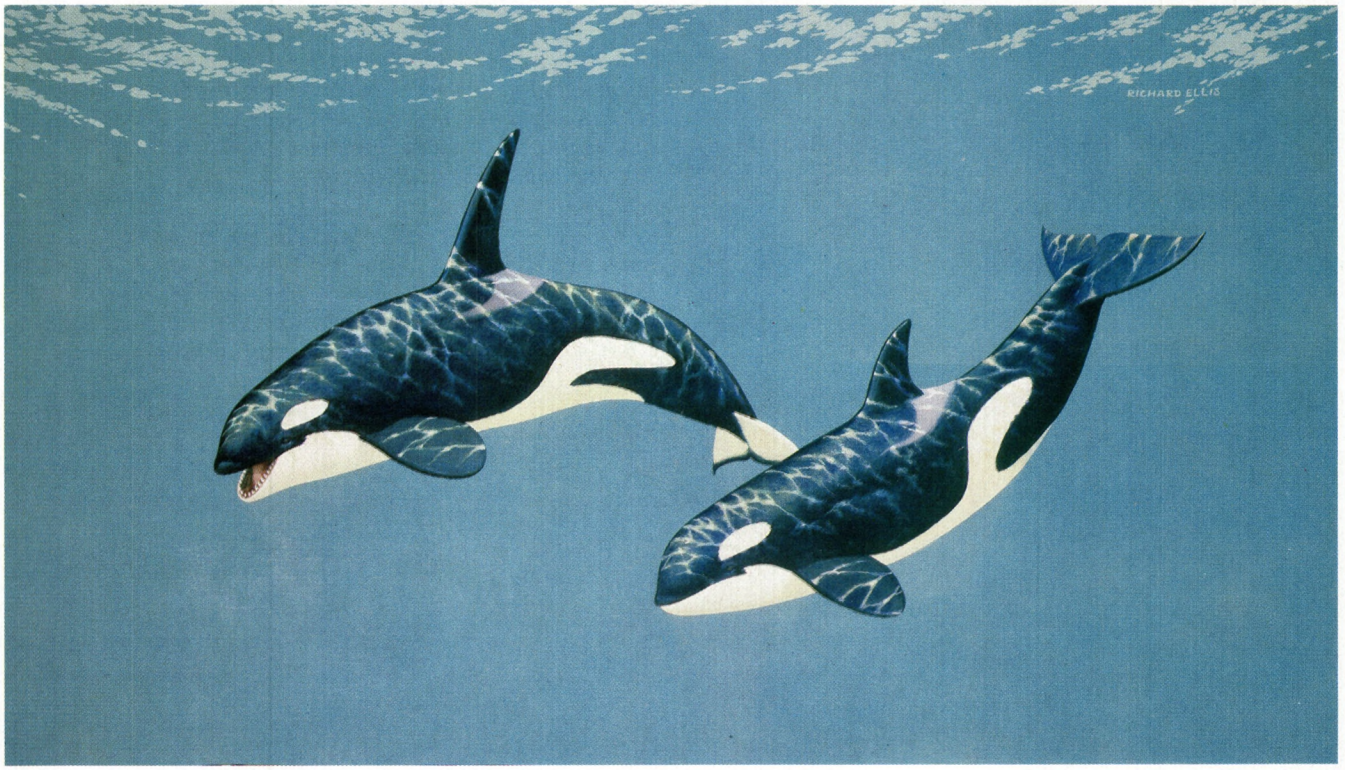
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RICHARD ELLIS

Aquatic Artist / Portfolio 4



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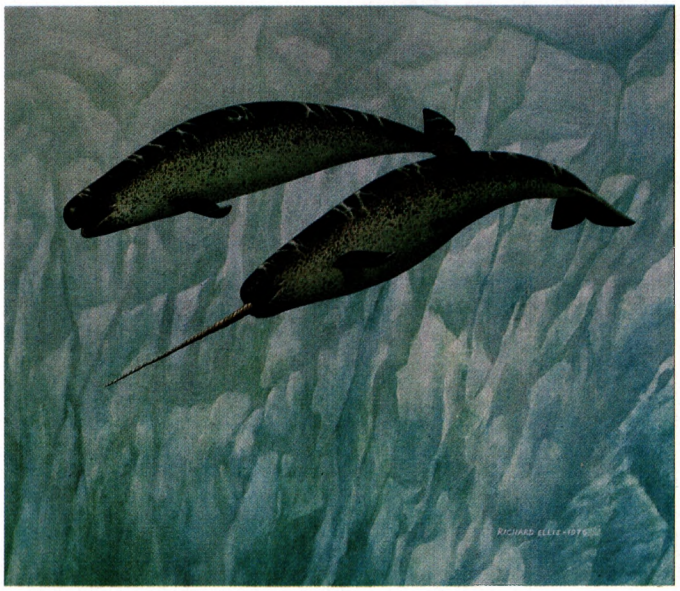
Richard Ellis's recorded observations of marine animals hang in numerous museums and private collections, and his paintings have been reproduced in virtually every major ocean-oriented publication, *Reader's Digest, Audubon* and the *Encyclopedia Britannica*. This final installment of the Richard Ellis portfolio exhibits the work for which he is best known—the whale paintings.

Although his first marine work was with shells, Ellis became disenchanted with the attitude and methods of collection of commercial shell merchants. He began painting whales, he says, because they symbolize perfectly man's insensitivity to the Earth and its inhabitants.

This portfolio contains some of the famous whale paintings plus a new work—the Killer Whales.

continued

Contrary to its terrifying name, the killer whale ***Orcinus orca*** *(preceding page) is generally docile to man except when severely provoked. Actually a giant dolphin (26' to 29'), the killer whale is a highly intelligent, curious animal with a well developed social structure. Males can be identified by a triangular dorsal fin (up to 6½' high); female dorsal fins are sickle shaped.*

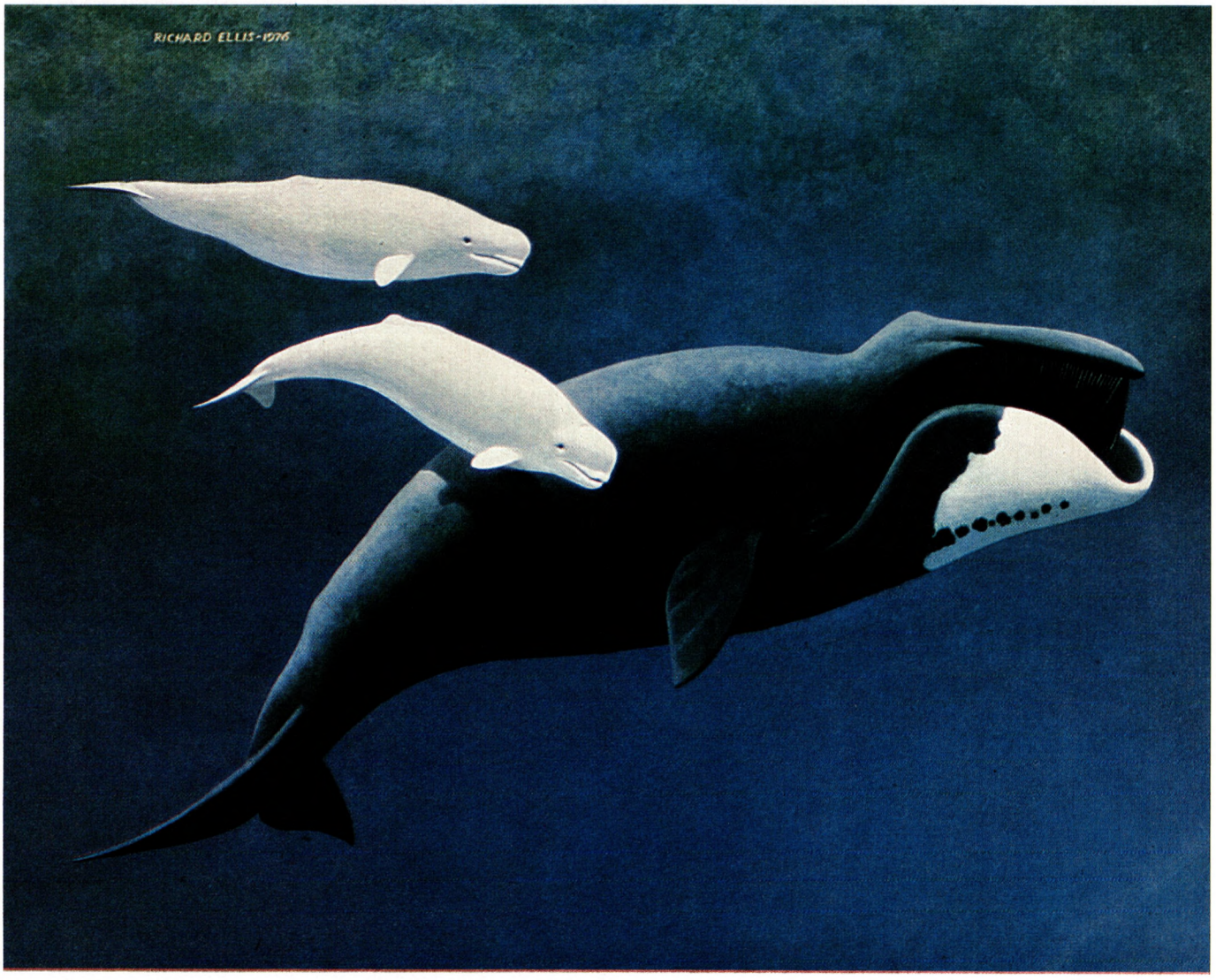


The sperm whale ***Physeter catodon*** *(preceding page, left) derives its name from the medieval belief that large quantities of semen could be found in the mammal's head. Feeding almost exclusively on cuttlefish and sepia (Cephalopoda), this large (20' to 65') whale regularly plunges to depths of 500 to 1000 feet in search of food, making it the second most efficient diver of all whales.*

During the Middle Ages, tusks of the narwhal ***Monodon monoceros*** *(left) believed to be magic or medicinal, were more valuable than gold. The straight, screw shaped tusk can attain a length of 8 ft. Fast, agile and harmless, these social creatures appear in groups of six or more, often all of the same sex.*

The white whale ***Delphinapterus leucas*** *(below left) also is known by its Russian name, "beluga." Preferring bottom dwelling crustaceans and fish, these relatively small (12' to 17') whales often hunt at great depths, although a smack of jellyfish, another favorite food, can induce them to the surface.*

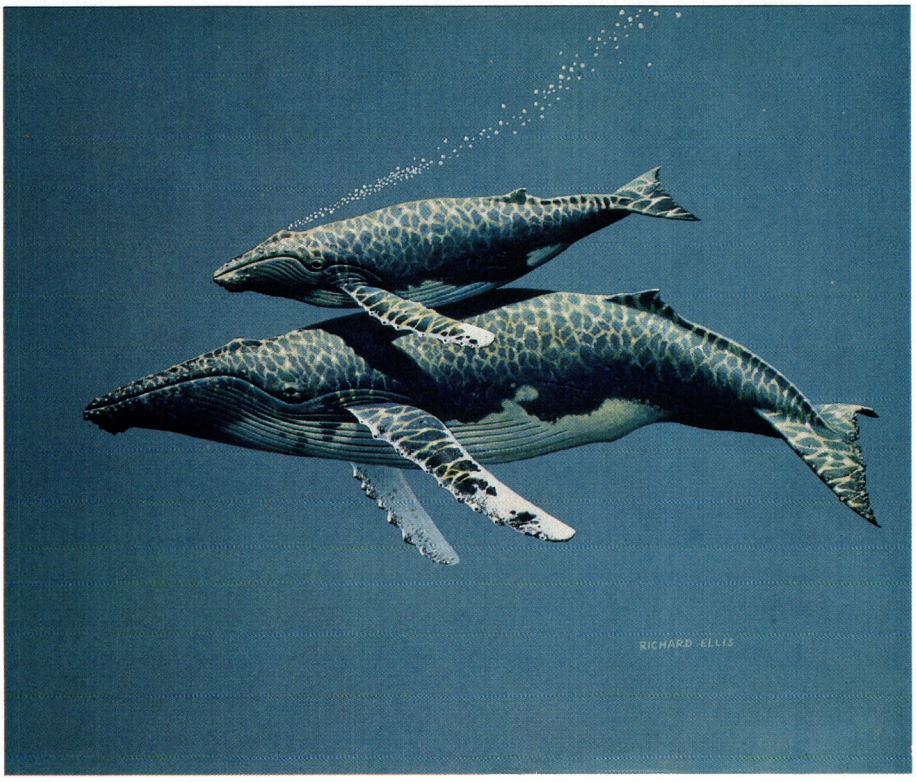
Today the rarest of all whale species, the bowhead whale ***Balaena mysticetus*** *(below) was at one time almost extinct. Fond of basking lazily near the surface, big (up to 59') bowheads presented an easy mark for a harpoon hurled from a whaler's longboat. Recent counts indicate the bowhead population has recovered and is growing.*





One of a genus of rorquals which includes the giant blue whale, the sei whale ***Balaenoptera borealis*** *(above) migrates in Spring to polar regions rich in plankton. Exceptionally fine baleen (a bony, fringelike seive in the upper jaw) enable the sei whale to strain miniscule plankton and shrimp from sea water. Sleek body lines and a thinner blubber layer than right whales give the sei whale an exceptional swimming speed which belies its large size (48′ to 58′).*

Also known as the "singing whale" for its melodic calls (available on commercial recordings), the humpback whale ***Megaptera novaeangliae*** *(right) is the only representative of its genus. Basically coastal inhabitants, humpbacks can often be found in harbors and estuaries of large rivers. Fantastic courtship displays during the mating season (April in the Northern Hemisphere, September in the Southern) include exchanging blows with breast flukes (which can be heard for miles), rolling from side to side, and jumping (at an average weight of 29 tons) completely clear of the water.*



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Zodiac dive boats are available in 10 models from the 10' 6" Mark I which has a capacity of 4 men or 880 pounds through the Mark V HD which is 19 feet long, has a capacity of 15 men or 4,000 pounds and can take up to 115 horsepower. There are also five dinghies available if your horizons are closer to home.

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FOR YOUR INFORMATION

1978 Greenstone Diving Safety Award



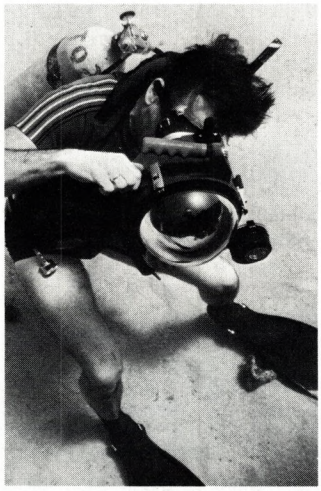
William L. High has been named as the recipient of the fifth annual Leonard Greenstone Diving Safety Award. Author of more than 60 articles on recreational and scientific diving, Bill has dedicated more than 20 years to the promotion of safety and education for divers on local, state and national levels. While serving as Diving Coordinator for the National Oceanographic and Atmospheric Administration, he prepared the Operational Diving Procedures for NOAA and contributed to the current revision of the NOAA Diving Manual. The Leonard Greenstone Diving Safety Award is given each year to an individual who has worked to advance the art of diving safety.

New NAUI U/W Instruction Course

The National Association of Underwater Instructors will offer a new course in Professional Underwater Instruction in San Diego this June. Designed for those who are professionally active in instruction, or who want to be, the program will emphasize techniques to better deal with student needs. Aspects such as group discussion and decision making, problem solving, case studies, role playing, brainstorming and values classification will be included with more traditional instructor-level training. Certification as an underwater instructor will be granted upon completion. Contact Jon Hardy or Judy Anne Pierce, NAUI Headquarters, P.O. Box 630, Colton, CA 92324.



Scuba Chrome International



A new world-wide association of serious underwater photographers has been formed to help promote excellence in underwater photography. For dues of $15 per year, members receive a 10% discount on all lab services from Scuba Chrome Labs, a bi-monthly newsletter edited by a 25-year veteran pro, SCI membership card, and vinyl decals for camera housings and luggage. Send $2 for descriptive folders and a sample newsletter to Scuba Chrome, 4911 W. Grace St., Tampa, FL 33607.

New Stamp Issue Available

A new postage stamp issue of fish definitives featuring brilliant color illustrations of fish indigenous to the Turks & Caicos Islands has been released by the British Colony of Turks & Caicos. The issue includes 15 stamps in values of 1¢ to $5, each featuring superb lithographic reproductions of one or more examples of marine biota to be found in the area. Sheets of 25 stamps may be obtained from the Inter-Governmental Philatelic Corp., 48 West 48th St., New York, NY 10036.



News from the Fashion Fringe

Hard put to find just the right gift for your favorite divemate? For just $24,000 to $39,000 (depending on market fluctuations) the diver of your dreams can have a week of dive instruction including accommodations at the best hotel suite in Honolulu, a 14 carat gold weight belt worth $14,000 to $28,000 depending on body weight, complete top-of-the-line equipment package including a $4,000 gold dive watch, and door-to-water Rolls Royce limosine service. Contact Aloha Dive Shop, Honolulu. Act now to avoid the rush.

$300 Duty Free Limit Cuts Customs Time

New duty free legislation now in effect allows residents returning to the US to bring up to $300 worth of merchandise into the country, including one quart of distilled spirits and 200 cigarettes. The next $600 worth of merchandise subject to duty will be charged at a flat rate of 10%. Travelers from the Virgin Islands, American Samoa and Guam will be allowed $600 duty free. The Air Transport Association believes the new rules will reduce the average traveler's time spent clearing customs to one minute.

Underwater University Convenes

The Professional Association of Diving Instructors has announced the opening of PADI International College in San Diego.

Modular course instruction in all areas of sport diving and underwater instructor training will be offered, as well as training programs from one to ten weeks' duration, ending in advanced or specialty certification. In addition, a two week course in retail dive store operations and management, ending in specialty certification, is available to non-divers. All course instruction is available in English or Spanish. For information, write PADI International College, 1310 Rosecrans St., San Diego, CA 92106.

continued

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No other career offers the international adventure and excitement of deep sea diving.

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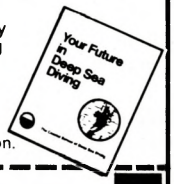
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FOR YOUR INFORMATION *continued*

Federal Help for Whales?

Endangered humpback whales should receive sanctuary from intrusions by high speed ferries and other hazardous marine traffic according to a resolution prepared by the Marine Wilderness Society. Presented to Hawaii's newly elected Governor George R. Ariyoshi, the resolution calls for establishment of a federal Humpback Whale Marine Sanctuary in the whales' breeding grounds between Maui and Lanai. The



Megaptera novaeangliae

National Oceanographic and Atmospheric Administration will evaluate the proposal for a sanctuary in 1979, and Governor Ariyoshi is empowered to approve or veto the plan. Humpback whales are one of only two species of large baleen whales which mate and calve in US waters.

RESORT UPDATES

US Virgin Islands

Coastal Diving Academy's 68-foot research vessel Black Coral is now operating in the US Virgin Islands. Based on St. Thomas, the seagoing classroom will offer on board instruction in basic, advanced and commercial



diving, underwater photography, and university accredited oceanography programs. Trips to reef sites, virgin wrecks and Caribbean elkhorn coral forests are scheduled, and the vessel is available for charter cave diving and night diving. Contact R/V Black Coral, 108 West Main St., Bay Shore, NY 11706.

Turks & Caicos

Divers visiting the Turks & Caicos Islands now have the option of staying in the largest hotel in the islands (25 rooms) with instant access to full diving services. The new diving facility, opened by Seaquatic Divers in the Prospect of Whitby Hotel, offers a full range of diving services and rentals for up to 25 divers at a time. Two boat dives per day are normally scheduled at sites including miles of virgin reef and a 6,000 foot vertical wall. Write Seaquatic Divers, R.D. #4, Box 1044, Middletown, NY 10940.

Caribbean Cruises

Cruise the Caribbean this year under sail aboard a 40-foot sloop or a 60-foot yawl. Oceanus School of the Sea offers a five month winter cruise with stops at Exuma, Haiti, Cuba, the Caymans, Roatan, and a journey up the lush Rio Dulce River in Guatamala to Lake Isabel. Total price of the cruise is $8,800 per person, or the expedition can be joined *en route* for stays as brief as a week. Each yacht will carry only four to seven participants, plus a knowledgeable crew who will offer instruction in sailing, seamanship, navigation, diving, underwater photography, coral reef ecology and archaeology. The non-profit expedition is "not geared to those demanding cocktails on the after deck, but rather to those with a love of the sea," says Director Ron Barr. Write Oceanus, P.O. Box 431, Ho-Ho-Kus, NJ 07423.

Bonaire

Frommer Charters has announced an expanded air schedule to Bonaire, Antilles from New York and Philadelphia. Two flights weekly will transport passengers to Kralendijk, Bonaire via Curacao or Aruba. From the Detroit area, Elliot Tours will offer weekly charters to Bonaire. Daily flights from Miami to Curacao with connections to Bonaire are available through ALM Antillean Airlines. ALM and Delta Airlines have announced a new joint excursion fare to the Dutch Caribbean starting at $329 (peak season) via Miami from Chicago, Cincinnati, Cleveland, Columbus, Dayton, Detroit and Indianapolis. Contact the airlines or Bonaire Tourist Information, 685 Fifth Ave., New York, NY 10022.

New Boat For Hollywood

Dave Inman of Divers Unlimited in Hollywood, Florida has announced launching of a new custom dive boat. Built to Inman's specifications, the 40' *Dolphin I* carries a



refrigerator and freshwater shower, a cutaway transom for easy access, and complete electronics. Skipper Bob Osborne, a Coast Guard certified ocean operator with 20 years of experience as a Navy Underwater Demolition Team member, will cruise out of Port Everglades for day and night dives at local diving sites. Contact Divers Unlimited, 4231 Hollywood Blvd., Hollywood, FL 33021.

continued



These pictures were taken at a depth of 30ft. using an ordinary camera lens and a specially-designed Clearoptic Lens.

The photo on the left is what you would see with a Clearoptic Super-Visibility Lens and photo below is what you would see with an ordinary face mask.

How you can increase diving visibility by 50% and see sharp colors underwater without the aid of artificial light.

By Ted Novak, Owner
KAPUKA WAI DIVE SHOP



Thanks to an amazing optical breakthrough, you can increase your diving visibility by 50% or more and see clear, sharp colors underwater without the aid of artificial light—whether you wear glasses or not.

If you've dived before, you know what kind of advancement this really is. At 50 feet, even in the finest diving waters, without the aid of artificial light, your visibility is reduced to a murky blue-green.

But, with the new Clearoptic Super-Visibility Lens you can see sharp, clear colors you've never seen before. The difference between the underwater visibility of ordinary masks and the Clearoptic Super-Visibility Lens mask is like the difference between black and white versus Color T.V.

How Clearoptic Super-Visibility Lenses were developed for divers.

Clearoptic Super-Visibility lenses were developed by an optical expert who is also an avid diver.

John Todd of John Todd Optical Company, the largest optical company in Ohio, has been diving around the world for years. He has never been satisfied with the decreased visibility of ordinary masks.

Putting his 20 years of optical know-how and his full-time staff of opticians and his laboratory to work, he set out to develop a low cost, personally fitted diving mask that would give any diver optimum visibility, at any depth, in any kind of water.

How Clearoptic Super-Visibility Lenses capture light to increase color perception.

Clearoptic Super-Visibility Lens is made with a special yellow glass. Since this special yellow is in the middle of the color range which the human eye can perceive, the lens captures and magnifies all available light.

Tailored to the human eye, your eye receives thousands more color impulses than it would with an ordinary face mask lens. It is this increase in color impulse absorption which allows you to retain up to 80% of your normal color perception—underwater!

The result is sharp, clear, colors and increased visibility at any depth, in any kind of water.

Clearoptic Super-Visibility Lenses.

I have tested these lenses worldwide in the waters of Micronesia, Honduras, Aruba, Grand Cayman, Miami . . . even the murky waters of Lake Erie.

And, the result is always the same. Increased visibility and color perception of 50% of more, without the aid of artificial light. These lenses are especially effective for underwater fishing. Increased visibility and perception means better aim and more HITS.

How you can get Clearoptic Super-Visibility Lenses for your Personal diving Mask.

Whether you wear glasses or not, Clearoptic Super-Visibility lenses can make your diving more satisfying and adventurous.

No piece of diving equipment is more personal than a diver's own mask. That's why the Clearoptic Super-Visibility lenses are fitted right to your own personal diving mask.

Clearoptic uses a unique method, known only to them to bind the lenses to your glass facemask. In fact, the bonding procedure strengthens the temper of your faceplate. These lenses are guaranteed for 5 years to give you increased visibility and color perception at the low cost of $55.00.

I would like to take advantage of your ONE TIME OFFER for prescription yellow faceplate lenses.
Enclosed find $40 check/money order plus COD and handling, my prescription, PD, and rubber (no plastic please) mask.
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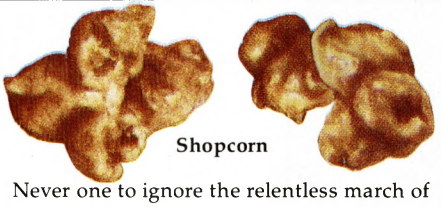
Diving for Drink

If you're into salvage diving, try this one. A case of Canadian Club whiskey awaits discovery somewhere off the northeast coast of Eleuthera, Bahamas. To find it, CC says you must "start where a dinner boat went down on Devil's Backbone Reef and follow a channel across the reef to an old Ward Liner steamer wreck." The distillers hint that the case lies near the site of a sunken railroad train. This brings to sixteen the number of cases hidden by Canadian Club in such locales as Mt. Kilimanjaro, Arizona's Superstition Mountains, the Venezuelan jungles near Angel Falls, the legendary Bigfoot feeding grounds in the Pacific Northwest and the island of St. Helena. So far, nine have been found. Go to it, salvors.



Scubapro Catalog Wins Recognition

Roy Brizz of Brizz Advertising displays the Scubapro catalog cover chosen by the Communication Arts Society to be displayed in their annual show. The Society annually selects examples of the best graphic arts in advertising from around the world.



Shopcorn

Never one to ignore the relentless march of progress, dive shop impresario and publicity monger Cap'n Don Stewart of Aquadventure/Habitat on Bonaire has announced installation of the first dive shop popcorn machine in the Caribbean. Occupying a prominent position near the bar in Habitat's new dive station, the device is reportedly doing a brisk business. Congratulations, Cap, and we hope you get those salinity problems worked out.

Disco Diving Fever

A diving disc jockey in Alabama may have earned a place in the Guiness Book of World Records by broadcasting from the interior of a submerged trash dumpster for 48 hours. Anchored 12 feet below the surface of Lake Martin, the converted trashbin was pumped 3900 cu. ft. of bottled air over the two day period since the primary compressor for the project failed to start. Says recordholder Dennis Carter, "I'm probably one of the few people in the world who can say they've eaten watermelon underwater at 4 a.m."



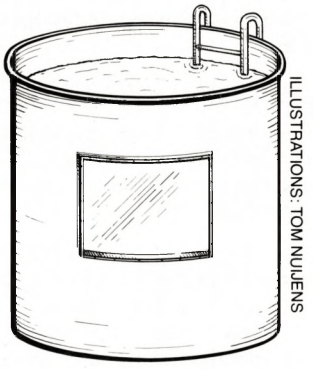
New PADI Low Cost Insurance

A new insurance benefits package available to members of the Professional Association of Diving Instructors offers comprehensive coverage, services and discounts in a group plan designed for PADI training facilities. Through an agreement with Support Services Alliance, Inc., the package includes high benefit group medical, life, and disability insurance in addition to discounts for car rentals, Xerox rentals, educational loan guarantees and a legal inquiry and referral service. Contact PADI, 2064 North Bush St., Santa Ana, CA 92706.

Planet Water '79

Celebrating its success on the road, the underwater film program Planet Water '79 will tour 20 major cities throughout the U.S. this year.

The Planet Water show is still available to local sponsors at an affordable fee. The package includes the film show, presenters fees and expenses, full color posters, vacation giveaways, advertising and promotional material, photo salon display and optional photo clinics, socials and T-shirt printing. Write Dan Conaway, P.O. Box 76721, Atlanta, GA 30328



ILLUSTRATIONS: TOM NUIJENS

...Just Add Water

"Deep Diver," a new product demonstration aid for dive shops, is a free-standing portable diving tank designed for in-store demonstration of equipment and student instruction. The one piece fiberglass tank is seven feet tall and seven feet in diameter, with a capacity of 2000 gallons. Pump, filter, recirculation system and a large view port are standard, and a hydrophone communications system is available. Contact Majestic Pools of Georgia, 419 Cobb Pkwy. S., Marietta, GA 30062.

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F-18150

PHYSIOLOGY

The Woman Diver

BY BRUCE BASSETT, Ph.D.

Despite the lack of adequate research, some startling new facts have emerged regarding women's physiological reactions to diving.

As women have become a larger segment of the diving community, the inadequacy of current data concerning the physiology of diving has become more apparent.

Initially, most compressed air divers were men, and all military divers were men. The physiological studies of the effects of diving were therefore conducted on men; usually young men. While the effects of diving on everyone else—older men, children and particularly women—have not been fully explored in the laboratory, some noteworthy observations on these effects have been made.

Anatomy

Most authorities in sports medicine agree women can participate on an equal basis with men in most sports, providing size and other anatomical differences are taken into account.

Size and stature have an impact on the use of scuba gear, which in the past was designed to fit the average male. Manufacturers are now producing equipment that is sized to the woman diver—to the benefit of youngsters and small-statured males as well.

Women have a greater proportion of fat per pound of body weight. Also, the female has 23 per cent muscle, compared to the male's 40 per cent. But because of hormonal differences, a woman can increase her strength 50 to 75 per cent without increasing muscle bulk. Since the nitrogen in compressed air is five times more soluble in fat than in non-fat, this may represent a liability to the woman in terms of decompression problems, but this has not been proven in the laboratory.

Menstruation

The general advice given regarding physical activity during the menstrual period is: If you feel well, do it. Both world and Olympic athletic records have been set by women during their periods. But does this advice apply to diving?

Firm knowledge relating stages of the menstrual cycle and susceptibility to decompression sickness, nitrogen narcosis or any other problem is lacking. There are indications that physiological changes related to the menstrual cycle can create problems. For example, fluid retention (edema) preceding and during the menstrual period may impair blood flow. This could slow nitrogen elimination during decompression and increase the likelihood of bubble formation and decompression sickness.

Generally, if you are experiencing severe cramps or discomfort during menses, it may be best to avoid diving or any other strenuous activity. Some women divers report an easing of such discomforts when they dive. If you are unsure how diving affects you personally, at least approach diving during your period with caution.

When diving three days prior to or during menses you should stay *well within the no-decompression limits of the dive tables.*

The danger of shark attack to menstruating women seems to be on the minds of both novice and experienced divers. The normal period results in a loss of 50 to 150 cubic centimeters of blood and cellular debris over three to five days. The blood lost is occult (old and clotted) which is believed not to influence shark behavior.

Finally, the small quantity of blood lost during any given dive (which is not lost if internal tampons are used) and the lack of any evidence of interest by sharks in a menstruating diver should allay fears provoked by this old myth.

Oral Contraceptives

There have been no direct laboratory studies conducted to date regarding the use of oral contraceptives and diving-related disorders. There are some indirect studies suggesting a relationship.

Side effects of the pill can include blood clotting problems. This is aggravated in smokers who take oral contraceptives. One study has shown that this effect may be related to increased adhesiveness of the platelets—those cellular elements of blood which play an important role in normal blood clotting.

There is also evidence that the formation of nitrogen bubbles in the blood after pressure reduction triggers changes in the clotting mechanism, including increased platelet adhesiveness. The extent of the clotting changes produced by bubbles is believed by some to be related to the type or severity of decompression sickness produced. Therefore, it is a rational concern that the pill may act in concert with bubbles to aggravate clotting problems related to decompression sickness.

If you are taking oral contraceptives there is a concern for safety, and until direct research is conducted, again the only advice can be to stay well within the no-decompression limits.

As an alternative, there may be other birth control methods which would be less likely to affect decompression sickness. A relatively new method is the *Progestasert System.* This intrauterine system differs from other I.U.D.'s in that it is a hormonal regulator like the pill, but the hormone acts directly on the uterus, not via the bloodstream. It would not be expected to affect clotting mechanisms. Diving instructor JoAnn Wesner is attempting to gather data on the use of this system by women divers.

An interesting footnote to this discussion is that the women in the Tektite program stopped taking oral contraceptives three months prior to their saturation diving.

Decompression Sickness (DCS)

In the classical publications on DCS the subject of sex as a factor in determin-

Dr. Bruce Bassett is a lieutenant colonel and chief of hyperbaric research at the Air Force School of Aerospace Medicine.

ing susceptibility to DCS is dealt with in three words: No data available.

However, there are some data available on DCS that indicate a greater incidence in women than in men. The first of such observations was made on a large number of individuals exposed to *reduced* barometric pressure during altitude chamber training in the U.S. Air Force. Altitude DCS is essentially no different from diving DCS.

From 1966 through 1977, 104 persons were treated for altitude DCS. Thirty-two of these were women. Records at the U.S. Air Force School of Aerospace Medicine, where 22 of the 32 DCS cases in women occurred, allowed determination of the incidence (number of cases divided by number of exposures) of DCS for both women and men. The incidence in men was 0.09 per cent, while in women it was 0.36 per cent.

More recently, Dr. Susan Bangasser reported that among diving instructors in Southern California, female instructors had an incidence of DCS 3.3 times greater than males or an incidence of 0.023 versus 0.007.

In analyzing the cases of altitude DCS occurring in the Air Force, individual and environmental factors as well as case data were reviewed. The analysis showed that women were four times more susceptible to altitude DCS, had more skin symptoms, had a more rapid onset of bends pain, and had more recurrences and lasting effects of DCS when compared to men exposed to altitude in an identical manner.

Several of the factors that may explain the difference in susceptibility have already been discussed: Differences in proportion of body fat; fluid changes in women as related to the menstrual cycle; and use of oral contraceptives.

Still, there are other questions that need answers.

Are there blood flow irregularities found in women, or more prevalent in some women, that increase the probability of DCS?

Are there differences in the blood that would be related to platelet aggregation triggered by bubbles?

Are vasospastic phenomena (constriction of the blood vessels) or release of vasoactive substances, as may be caused by bubbles, more likely to be found in some, or all, women?

Pregnancy

The first study of the influence of decompression on developing fetuses was

continued

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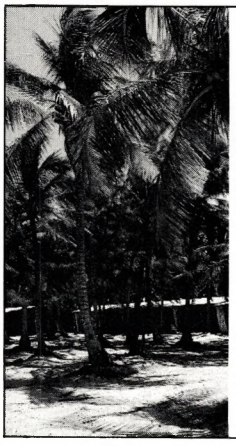
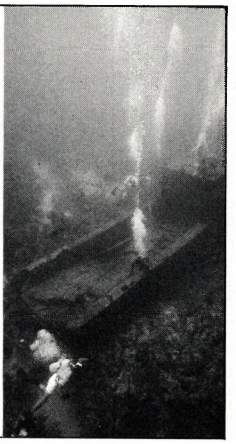
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performed on dogs. It indicated the fetuses were resistant to bubble formation even when the mother had lethal DCS and bubbles were present in the amniotic fluid. Similar findings were produced in experiments with rats.

However, the most recent laboratory studies using pregnant sheep produced opposite results—massive bubble formation in the fetus while the mother was bubble-free.

Firm conclusions cannot and must not be drawn from such preliminary studies. Of course, you should not be lulled into a false sense of security because a few acquaintances dived while pregnant with no apparent harmful effects on the mother or her offspring. The name of the game in science is statistics, not trusting your good luck.

New decompression studies must be performed on more animal species, preferably including primates with placental circulations close to the humans, and at different periods in the animal's pregnancy. Then, and only then, may firm conclusions be reached and guidelines established.

Decompression is only one hazard to the pregnant diver's developing fetus. Other hazards include hypoxia and oxygen toxicity—too little or too much oxygen.

Too little oxygen could occur if circulation to the fetus is impaired, as can happen due to the mammalian diving reflex, or due to the autonomic nervous system's response to stress. Oxygen toxicity could occur with deep diving. Breathing compressed air at 124 feet of sea water produces an inspired oxygen pressure equal to breathing pure oxygen at sea level. It could also occur if a pregnant diver had to be treated for DCS or air embolism, since treatment requires use of 100 per cent oxygen at depths up to 60 feet.

If newborns, particularly premature newborns, are exposed to 100 per cent oxygen in incubators at sea level, irreparable damage is produced in the retina of the eye, leading to blindness. It can be assumed that the developing fetus may also be particularly sensitive to increased oxygen pressure.

Most of the real world experience with pregnant divers consists of statistics gathered by Sue Bangasser and by Margie Bolton. Neither study has, to date, revealed problems related to diving while pregnant. But again, the record is far from complete and the statistics, the odds, have yet to be developed.

The Undersea Medical Society recently held a workshop on the effects of diving on pregnancy. Portions of this article summarize discussions held there.

A poll taken of the workshop participants showed a majority voted it was the pregnant diver's choice as to whether to dive or not, but stipulated the decision be based on informed consent. Also, there were more who felt the diver should abstain during pregnancy.

Once again, back to Sue Bangasser, who was one of the seven divers in her survey who dived through her ninth month of pregnancy. Obviously, she believes the pregnant woman can dive, *if* she uses good sense, and makes only single dives to less than 30 feet.

Since a woman may not realize she is pregnant for the first six weeks, diving during this period poses its own problems. Deep or repetitive dives performed in the early stages of pregnancy may be the greatest threat to the developing fetus. Therefore, if you discontinue birth control and plan to have a family, you should begin to dive within the guidelines for pregnant divers—single dives to less than 30 feet.

Until further studies are performed, both laboratory tests and surveys of diving women, the pregnant diver should be aware there are serious risks and that there is not enough data to provide absolutely safe dive profiles for the human fetus.

There is a Difference

Physiologically, there are some real concerns regarding diving women. This does not mean women should not dive, that they are weaker or are in any way inferior to their male diving counterparts. Women are no different from men in their abilities to learn, to dive and to revel in the underwater experience. The difference is that there is not enough solid research data to say that all diving is safe for all women all the time.

For More Information

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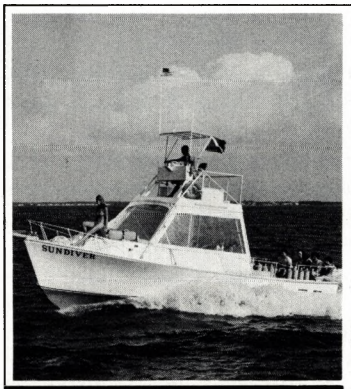
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Dive Boats You Can Buy

For too long divers have made do with made-over fishing craft. Now there are some custom-designed dive boats, but the selection is limited.

BY JAMES DUNCAN



RICHARD H. STEWART

Someday a psychologist will stumble upon the odd mating of sport divers and boats. Aha! the shrink will say, here's a virulent new strain of masochism.

We divers trip over motor wells, shimmy up outdrive units and wrestle anchor lines across slick bow decks until the pain feels nearly natural.

Why don't we buy boats that would save us some grief?

"I would be afraid to build a boat designed strictly for diving," said Jim Dietz, vice president of Phoenix Marine. Phoenix is a quality South Florida builder of shallow draft, stable, blue water boats. Those qualities mean Phoenix has won half the battle in building a proper dive boat. But Dietz won't take the full plunge.

"I'm just not sure there are enough people with the money to buy a boat built mainly for scuba diving," he said in an interview at the 1979 Miami International Boat Show.

A beginning sport diver often spends $1000 or more on gear and instruction. An average fisherman, on the other hand, owns less than $100 in gear, according to industry surveys. Yet builders make boats for bonefishing, for redfish angling, bass jigging and downrigging on reefs. Any day now, I expect a builder to market a boat especially designed for fly casting for snook on the outgoing tide while anchored under a bridge in the Upper Florida Keys.

But a dive boat?

"Divers seem to make almost any boat do," said Bill Munro, vice president of Mako Marine. His company shelved plans to make a Mako dive boat this year. "The specialized dive boat looks like a very narrow [buyer] market."

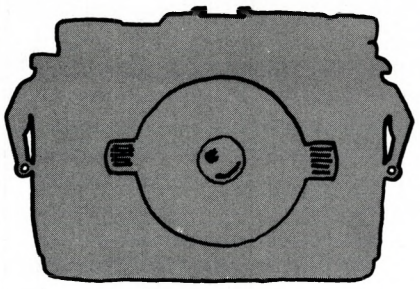
The pleasure boat industry might be confused by the difference between the casual diver and the true aquaholic. Many California and Florida boat builders and designers are divers themselves. That is, they carry a couple of tanks when they go on family outings. They may dive a little, snorkel a little, drift fish a little, or just picnic in a quiet cove.



Of the very few boats built exclusively for diving, only the Bristol Blue Water Flattop (top) and the Livesay have gained any wide distributorship. Still, these manufacturers make a very limited number of boats each year, and each new one is something of a custom order.

continued

James Duncan is a freelance writer and a regular contributor to ***Sport Diver.***



TAKE THE NEXT STEP

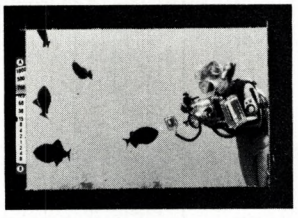
Single Lens Reflex (SLR) cameras are used underwater for the same reasons they are chosen by amateur and professional above water photographers. SLR cameras offer built-in exposure meters, thru-the-lens viewing and focusing, auto exposure, a wide range of interchangeable lenses, bulb or electronic flash, viewfinders and other related accessories. The IKELITE SLR Case allows the use of these cameras and their features underwater.

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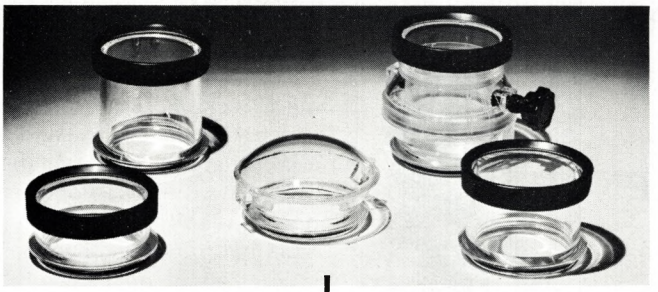
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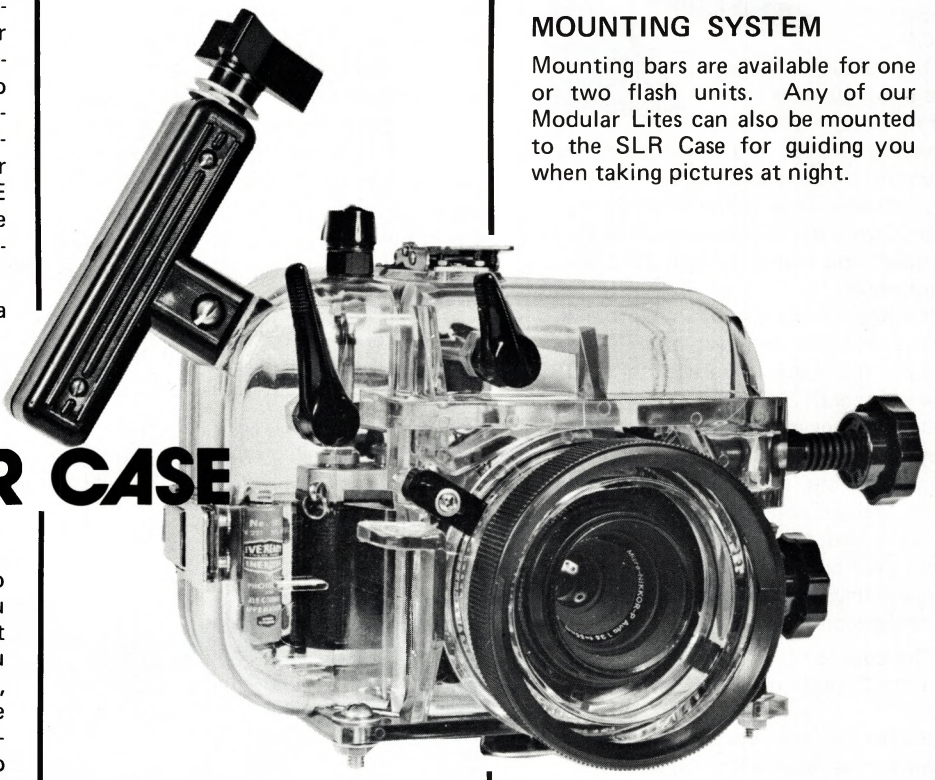
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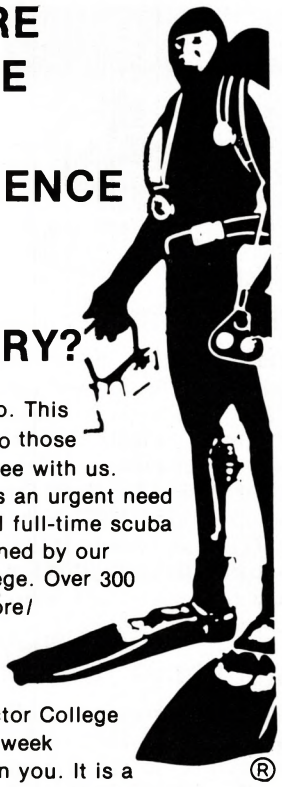
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Casual divers don't mind performing a backroll entry while wedged between a Bimini top strut and a springline cleat. That's just a minor discomfort to someone who dives only eight to ten times a year. They don't complain about hauling up 200 feet of anchor line while flailing about on a pitching, slippery bow deck because they dive mostly in 35 feet of calm water.

And if you're a casual diver, just about any old boat—with modification—will do. Casual divers make up the majority in our sport. But the serious diver needs a different boat.

Consequently, a few custom dive boat builders are getting better known, despite some handicaps. It is complicated for most boaters to deal with a builder who may be thousands of miles away and has no local distributor. Moreover, custom builders often require the buyer to help design his boat. That's easy enough for a professional skipper, but it's a tricky business for the amateur.

Until recently, custom builders like Livesay Manufacturing, of Santee, California, and Bristol Bluewater Boats, in South Norwalk, Connecticut, sold almost exclusively to commercial and government users.

"Livesay builds a very rugged, incredibly seaworthy boat, and they live up to their obligations to their customers after the sale," says Tom Stephan of the California Institute of Technology. The university's Kerckhoff Marine Laboratories use a 26-foot and a 32-foot Livesay for wide-ranging research into kelp ecology.

The Livesay on first impression appears to be a traditionally modified vee hull. But closer inspection reveals that the boats are uniquely adapted to rough use and heavy weather. Bow flair has been enlarged to help the boats climb big swells. Aft chines are designed to help the boat sit flat at anchor. Deck and hull fiberglass layup is unusually heavy.

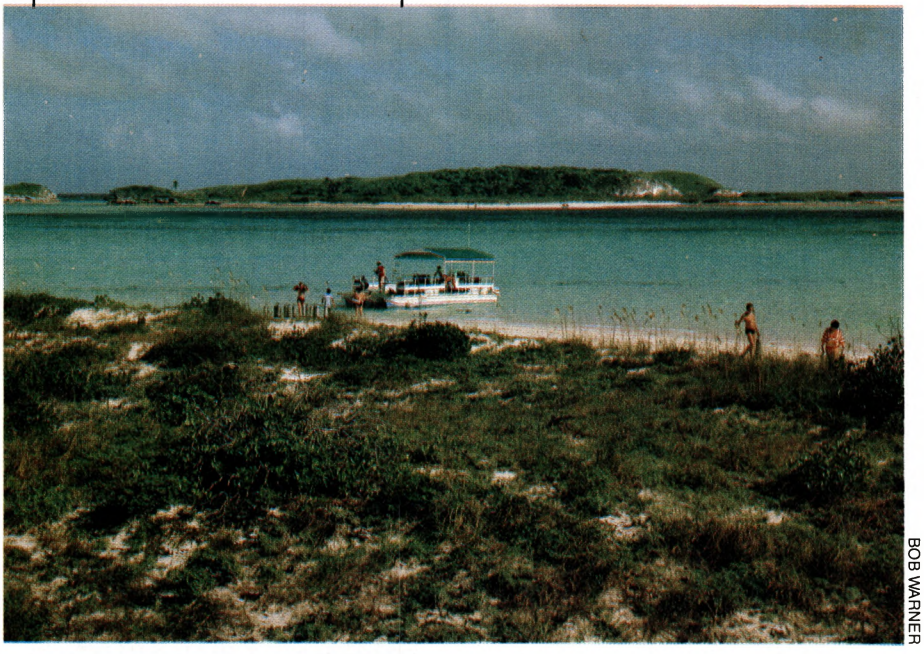
"No one is harder on a boat than a diver," Jay Livesay said. "Most production boats are just not built to handle that kind of abuse."

The first Livesay, a 16-footer, evolved through five years of refinement to serve as an open-ocean chase boat in the tuna fleet. Stephan called it a "whizzbanger."

Livesay (rhymes with "give-say") prices range from $8,000 for the outboard-powered 16-footer to over $60,000 for a fully-outfitted, 32-foot flybridge model. The company builds 50 boats a year. Standard equipment on the 16-footer includes a bench seat with storage, rack for eight scuba tanks and two below-deck storage boxes.

Bristol Bluewater Flattops are anything but traditional. They are power catamarans and trimarans, often mistaken for pontoon boats. A blue water sailor's first reaction to the flattop often is skepticism. That doesn't include sev-

The large deck area and built-in tank racks have made the Bristol Flattops popular with many dive tour operators.



BOB WARNER

eral Caribbean resort owners, who are true believers and make up the company's largest customer group.

"When I first saw the boat, I said, sure, it's okay for lakes and flat water on the lee side of islands," said Dave Inman, owner of Divers Unlimited, Hollywood, Florida. "Then I tested the little 22-footer in a chop offshore.

"The thing just gets up on top of the waves and goes. Dry and sturdy. I wouldn't see anything wrong with taking one across the Gulf Stream."

Bigger ones, in fact, have been delivered to the Cayman Islands under their own steam, according to company spokesmen. The 22-foot catamaran, with eight-foot beam, starts at about $7000 without power. A 34-foot trimaran, with 12-foot beam, begins at $25,410 without power. Special diver features of the flattop are a specially constructed aluminum dive ladder and one tank rack per seat. The 22-foot model is rated for six divers. Engine options range from single outboards to twin diesel outdrives. Bristol Bluewater builds 60 to 100 boats a year.

Clearly, proper dive boats may come in different shapes. But the intent of the designs is the same. A good dive boat can go as far offshore, in as bad a weather, as the owner wants while using reasonable caution. But the boat must have a shallow draft and protection for props and propeller shafts to run safely along reefs.

The boat has to be strong enough to take the shock of dropped air tanks. It needs to sit stable at anchor, while providing easy boarding for people wearing heavy gear. A dive platform at least 36 inches wide is an obvious necessity. The helm station should have both good visibility and adequate weather protection for charts, depth sounders and radios. A good dive boat has a safe path to the bow for dropping and weighing anchor, and plenty of accessible stowage for anchor, line and chain.

Many readers already will have noticed that a boat with these features is a more seaworthy craft than its fishing boat counterpart.

In fact, Coast Guard inspectors tell me that dive boats custom-built for licensed passenger duty often qualify for offshore routes with ease. For example, the cutaway transom used for easy diving and boarding on many dive tour boats also acts as a huge scupper. It often will drain water out of cockpits faster than regulations require.

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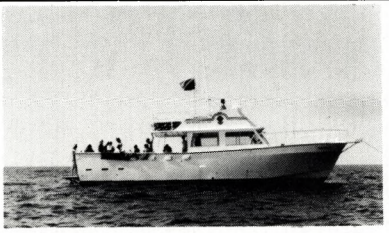
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The larger Bristol Bluewater Flattops are scheduled for tests for offshore routes this year. Positive buoyancy and sideways balance, provided by the Flattop's foam-filled, fiberglass vee hulls, are likely to please the Coast Guard inspectors.

None of Livesay's customers so far has requested a boat licensed for offshore passenger routes. However, some key Coast Guard requirements already are built into the Livesay dive boats. They include watertight hull compartments for flotation.

"Scuba divers often are viewed as the Keystone Kops of boating," Jay Livesay said. "They go out, get wet and stay miserable. They really need to be educated about boats."

In short, boat pain shouldn't be part of the sport.

Choosing an Inflatable



"Rubber duckies" have come of age—and for divers they match anything a hard-hulled craft can offer.

BY DON HUBBARD

Power boaters call them rubber duckies, bouncing betties or gas bags. Inflatables are not sleek, stiletto-styled speed boats, so it's difficult to appreciate their finer qualities just by looking. If you're accustomed to operating from a small hard-hulled craft, your first dive from an inflatable will be an immensely pleasureable experience.

Modern inflatables are tough, stable, buoyant boats that can do anything a hard boat can do, and in some cases do it much better. It is not surprising that sales of inflatables has become the fastest growing segment of the boating industry in America, and the trend seems to be accelerating.

Part of the growth has been due to discovery of inflatables by divers. If there is one small boat that has been designed for the diver, it is the inflatable. First, the boats are so compact and portable they are easily transported to rugged areas inaccessible to trailered craft. Once there, you don't need a ramp to get into the water. You can launch them across beaches or through the surf, carrying payloads that would swamp many hard-hulled boats. And if your timing is wrong and a big wave fills the boat, the air-filled hull will still be floating high enough for the engine to run, even with you and all your gear aboard.

Inflatables are supremely stable, allowing top-heavy divers to stand to adjust equipment without danger of capsizing. The encircling air-filled pontoons provide a wide base of flotation and a soft after-dive entry to the boat.

Economy is another big attraction. You can eliminate the costs of a trailer; both the heavy initial investment and continuing expenses like licensing and ramp fees, lower automobile mileage, maintenance and storage. Also, because the hulls are lighter and move over the water more easily, you can use a smaller boat with a smaller engine to accomplish the same job. With high-speed planing boats, this combination can reduce fuel costs by 50 percent.

Maintenance costs are lower because the permanently coated and pigmented hull requires only a fast rinse to remove gravel, sand and shells, and an occasional scrubbing with soap and water. You can be out making bubbles while the hard boat owner is sanding, caulking, priming and painting.

The Drawbacks

Reduced interior space is one major problem. A 14-foot boat with a six-foot beam may have a cockpit area only eight feet by three feet. There are some ways to save space here, but the truth is that inflatable boats can be crowded.

High-speed inflatables also tend to bounce more than boats with hard hulls, especially in choppy seas. The bouncing can be minimized by reducing throttle and watching and playing the waves, but the bounce can't be eliminated totally.

Types Of Inflatables

With the increased popularity of inflatables, new models are showing up in a multitude of shapes, sizes, colors and styles; often at suspiciously wide variations in price. You not only must decide what make and model to buy, but know why two seemingly similar inflatables sell for very different prices.

There are three basic types of boats suitable for diving: open canoes and kayaks, soft-bottomed dinghies, and high-speed, u-shaped sportboats. The last category includes the hybrid boats that combine an inflated upper hull with a fiberglass bottom.

Canoes and Kayaks

Because of their rather limited, narrow interior space, canoes and kayaks are probably best suited to free diving. There

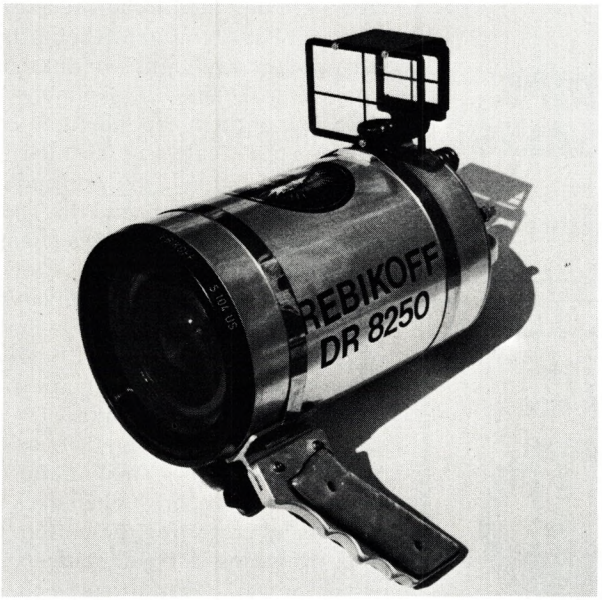
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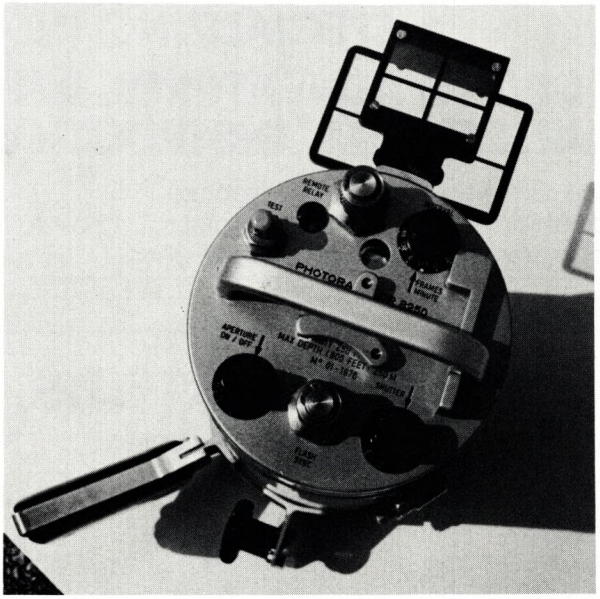
Don Hubbard is a freelance writer and former retailer of inflatable boats. His book on inflatables will be published this spring.

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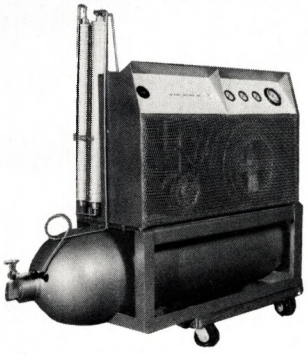
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is no question that an inflatable canoe will get scuba divers there and back. They have plenty of buoyancy, and as narrow boats go, they are stable. But when you are carrying a lot of hardware, this is not hassle-free diving.

Dinghies

Dinghies and tenders come in many sizes and styles. Most are smallish, in the eight to ten-foot range, although a few companies offer 12-footers. These boats are designed to be used as shore boats for larger craft, and their principal advantages are light weight, super-compactness, and fast assembly. However, few of them can mount an engine of any appreciable size, so their speed is severely limited. Six horsepower is usually the maximum, and this shortage of power necessarily makes them displacement hulls. This means they push through the water instead of planing on top, and three to four knots is the average speed. Low speed and limited interior space restrict the distance you can comfortably travel, and reduce the number of available diving sites to those within a relatively small radius. The addition of an inner wooden deck helps matters by protecting the bottom fabric and providing a rigid platform from which to work. The stiffening the deck imparts may add a knot to the speed.

Sport Boats

In all, the dinghies are not bad diving boats, but they are no match for the high-speed sport boats. The sport boats are planing hulls. Given sufficient power, they skim along the surface of the water chewing up great chunks of territory and enlarging your potential area of underwater exploration. The smallest sport boats start at about nine feet in length, and go up from there. At least one importer offers a model which is 27 feet long and can mount a 250 horsepower engine. These are extremes. The majority of sport boats range from 12 to 16 feet in length, combining ready portability with good carrying capacity.

Sport boats have vee hulls that enable them to slice through the water, and to some extent, the characteristics of the different boats are determined by the way in which the vee is formed.

The hybrid boats accomplish this by joining a hard lower hull to an inflatable upper body. This reduces their portability, and means you will likely have to haul them around on a trailer. It also adds weight. But the solid bottom lets

these boats run through even the roughest water at high speed with a minimum of bounce. Hybrids require larger engines because of the extra weight, but this is compensated for by the more comfortable, and often faster, ride.

Conventional sport boats use either wooden or inflated keels, both of which are forced downward into the bottom fabric by overlaying floorboards. Wooden keels are usually sectionalized for ease of storage, and add a bit of extra weight and perhaps an extra bag. However, wood increases the longitudinal rigidity of the hull and helps to reduce bounce. The sharper vee of the wooden keel also cuts water better, permitting the boat to make sharper turns.

Inflatable keels form a less distinct vee, and bounce most in rough water. This is offset by their lighter weight, compactness when stored, and resilience when they collide with hard objects, like drifting wood or rocks on the beach.

In actual practice, the type of keel structure is not that significant except in the hybrids, and if other particulars make any one boat appeal to you, it doesn't make sense to let the keel type become the determining factor.

Size

When selecting an inflatable, the challenge is to strike a balance between carrying capacity, usable internal space, and portability. If you want an inflatable because of its unique qualities as a dive boat, and are not concerned about portability, go ahead and buy a big one and put it on a trailer. However, if you intend to store the boat after each dive, or pack it in a vehicle, the weight is important.

The most practical boats, which combine light weight, good carrying capacity and some internal space are those in the 12 to 16-foot range. Of course the small dinghies are useful for diving, and it's true that four big guys can make good use of boats over 16 feet and will still be able to pick them up and move them around. But for the average diver who must often load his equipment alone, big boats can be a drag.

Large boats and large diving groups also mean larger engines, and again portability becomes a problem. The optimum diving inflatable is about 14 feet long and is powered by a 20 to 25 horsepower engine. The boat will weigh about 200 pounds, and should break down into two roughly equal packages. The engine will weigh around 100 pounds, less gas tank, so it can be loaded by one person.

Fabric

The single most important component of any inflatable boat is the material from which it is made. Inflatables made of quality fabrics not only perform infinitely better, but have the durability and life expectancy to match hard-hulled boats. Boats made of poor fabric are unsatisfactory because they can't operate at sufficient internal pressure to keep them reasonably rigid, and they deteriorate rapidly.

Two basic types of material are used. Many inexpensive boats are made of sheet plastic which is not superimposed on any sort of fiber base. Boats of this type cost less because the material is far cheaper, and they can be manufactured quickly using heat welding machines to join the seams. Most boats of this type are little better than beach toys. However, some manufacturers use this same material in heavier grades to produce boats that are reasonably tough, considering the cost. Unreinforced plastic, even in heavier grades,



Left: Hybrid boats combine a rigid lower hull with an inflatable upper. The hard bottom affords a more comfortable ride in rough water, but the extra weight reduces portability and requires a larger engine.

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ZODIAC
Zodiac of North America, 11 Lee St., Annapolis, MD 21401

stretches under tension, especially when warm. Boats of this type can never approach the rigidity needed for a diving boat, or carry the engine needed for top performance.

Generally, the larger boats are made using coated fabrics, and the better ones use modern, long-lasting synthetic materials. Some very cheap models use base fabrics made of inexpensive natural fibers, like cotton and hemp, coated with natural rubber or a rubber-Neoprene mixture. Life expectancy of these boats is short. Both the fibers and the coatings deteriorate rapidly.

Nylon, polyester, and the new super-lightweight Kelvar have been used as base fabrics. These are coated with any number of synthetics, including Neoprene, Neoprene covered with Hypalon (another form of rubber with greater resistance to abrasion and weather), Neoprene-Hypalon mixtures, polyvinylchloride (PVC), and Urethane. All of these can produce tough boats when properly compounded, and are highly resistant to damage.

Of course, each manufacturer claims his particular combination of fibers and coatings is the ultimate. No doubt there are small variations, and I suppose a scale could be made which rates each combination against the others. The truth is that, workmanship aside, all of these materials have long life and perform well for divers.

It is probable that fabric weight is a more significant factor than the combination of materials. The lighter the fabric, the less punishment it will take. This does not mean you have to buy a double weight boat; just avoid the real flimsies.

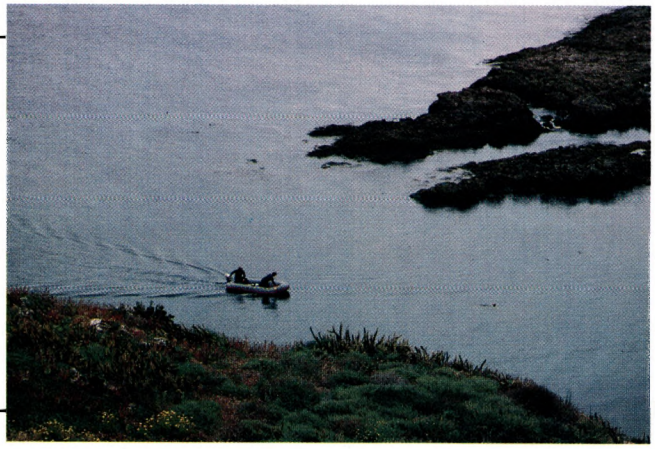
A lot of strange terms are bantered around by marine salesmen when they talk about fabric weight; things like denier and ounces per square yard. Most are meaningless to the customer, and they are not used consistently by the manufacturers. Look over the material yourself. Tough material *feels* tough. If possible, compare the fabrics of two or more makes of boats. Some companies use lighter material on their smaller craft. This does not necessarily mean lack of quality. They can save weight here because there is less stress on smaller boats, due to smaller engines and smaller loads.

Workmanship

Quality of workmanship will affect the cost. Boats made of reinforced fabric are almost always made by hand. The fabric pieces are machine cut, but the alignment and cementing of the parts is done by skilled workmen. The seams of a good boat will be smooth, even and clean; no lumps, ripples or smeared glue. A top-performing inflatable is a precision machine, and it will look it.

Operating Pressure

Recommended operating pressure is another indication of quality. In the





Right: Smaller inflatables can be used to get two divers into sites almost inaccessible by other means. Far right: Soft bottoms make inflatables amenable to rough use, such as beaching on a rocky shore.

continued

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cheaper fabrics, the coating materials are often poorly bonded to the fiber base. When two pieces of this material are cemented, the bond is usually stronger than the fabric. When excessive internal pressure is applied, it is not unusual for the impregnating substance to part from its base, splitting the seam. Many poor quality boats will specify the use of very low internal pressures, usually three-quarters to one psi. Any good hull made of reinforced fabric will specify a pressure in excess of two psi, and most run three to four psi.

In inflatable boats, quality costs money. In boats of comparable type and size, it is generally true that for twice the money, you will get ten times the boat. Good boats perform better, last longer, and their resale value stays high. Sort of like the old Volkswagens.

Inflation

Most boats assemble easily if you follow directions. Adding air is the big problem, and this can mean 15 or 20 sweaty minutes with the hand or foot pump. Your best bet to speed things up is a small 12-volt inflator. The ones made for tires are not very useful as they put out a lot of pressure but little volume. A good boat pump is a small hand vacuum cleaner with the ends reversed. These put out lots of volume at low pressure. You will have to finish the job manually, but most of the work is done. You can use an extra scuba tank, but it's risky. One owner ripped a 53-inch gash in his 16-footer this way. If you do use a tank, release the air *very* slowly and shut off the tank well before the hull gets hard, then finish the job with a manual pump.

Using the correct pressure is important for efficient operation. Most people under inflate the boats so as not to damage them. Forget that. Take the hull up to full pressure, and then add another quarter of a pound to compensate for contraction when the boat is put in the water.

Inflatables have always been good dive boats. Accelerated technology has given them the speed and durability to compete with hard-hulled craft toe to toe; and they still have one singular advantage—they are more portable than anything else afloat.



Wheels for Divers

Boats work fine in the water, but you'll need wheels to deal with the other one-third of the world.

Once you have a boat of the appropriate type and size, you'll need wheels to get it close to your favorite dive site for launching. If you're going to launch an inflatable from the nearest marina, a Volkswagen Rabbit will do it. But if your idea of diving adventure is exploring those spots no one else goes to because they're too hard to reach, or you've purchased a miniature ocean liner, something a tad larger is suggested.

The following selection is by no means exhaustive, it is just a sampling

Chevrolet Sportvan/Nomad

Manufacturer: Chevrolet Division
General Motors Corporation
Warren, Michigan 48202
Base price: $4857—5758
Vehicle type: front-engine, rear-wheel-drive
Body styles available: 4-door van

DIMENSIONS

Wheelbase	110.0—125.0 in
Track, F/R	68.5—69.3/67.0—74.1 in
Length	178.2—202.2 in
Width	79.5 in
Height	78.8—81.2 in
Curb weight	3650—4050 lbs
Gross vehicle weight rating	4900—8550 lbs

SUSPENSION

F: ind, unequal-length control arms, coil springs, anti-sway bar
R: rigid axle, semi-elliptic leaf springs

BRAKES

F: vented disc, power-assisted
R: drum, power-assisted

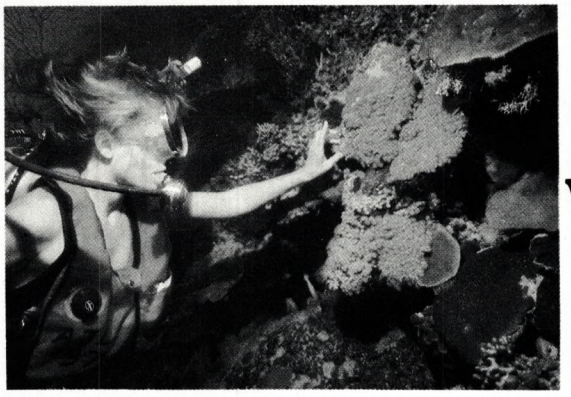
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City 13—17 mpg

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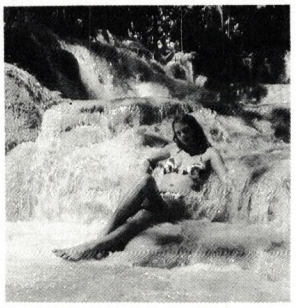
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Dodge Ramcharger

Manufacturer: Dodge Truck Division
Chrysler Corporation
Detroit, Michigan 48288
Base price: $5497–7016
Vehicle type: front-engine, rear-wheel-drive/four-wheel-drive
Body styles available: 2-door wagon
DIMENSIONS:

Wheelbase	106.0 in
Track, F/R	65.7/63.4 in
Length	184.6 in
Width	79.5 in
Height	69.8–73.3 in
Curb weight	3550 lbs
Gross vehicle weight rating	4800–6050 lbs

SUSPENSION

F: 2wd:	ind. control arms, coil springs, anti-sway bar
4wd:	rigid axle, semi-elliptic leaf springs, anti-sway bar
R:	rigid axle, semi-elliptic leaf springs

BRAKES:

F:	vented disc, power-assisted
R:	drum, power-assisted

EPA ESTIMATED FUEL ECONOMY

City	14–17 mpg



Ford F Series Pickups

Manufacturer: Ford Motor Company
P.O. Box 43303
Detroit, Michigan 48243
Base price: $4647–7072
Vehicle type: front-engine, rear-wheel-drive/four-wheel-drive
Body styles available: 2-door pickup, 4-door pickup
DIMENSIONS

Wheelbase	117.0–166.5 in
Track, F/R	64.4–65.3/64.4–65.0 in
Length	217.3–233.5 in
Width	79.1 in
Height	71.1–73.9 in
Curb weight	3900–4600 lbs
Gross vehicle weight rating	5500–10,000 lbs

SUSPENSION

F: 2wd:	ind, swing axle, coil springs
4wd:	rigid axle, leading link, coil springs, Panhard rod
R:	rigid axle, semi-elliptic leaf springs

BRAKES

F:	vented disc, power-assisted
R:	drum, power-assisted

EPA ESTIMATED FUEL ECONOMY

City	13–18 mpg

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These vehicles come in a variety of colors, with special paint jobs and luxury-option packages designed to make you think you're buying a passenger car. Don't be fooled. What you're really interested in is how much it will hold and how much it will haul. The Gross Vehicle Weight Rating (GVWR) minus the curb weight tells how many pounds of tanks, weights and oversized diving buddies you can pile in. The GVWR will vary for different models of the same vehicle, depending on the suspension package ordered. All of these vehicles will trailer up to 2000 pounds without modification, other than adding a trailer hitch. If you plan to pull more than 2000 pounds, you may need to order a special trailering package that includes a weight-distributing hitch platform; extra water, engine oil and transmission oil cooling; heavy-duty electrical system; and a larger engine.

Once you've got the right vehicle with the right suspension in the right price range—consider your ego. Properly sporterized, one of the 1979 mulewagons can do wonders for your self-image right down to the water's edge. After that, you're on your own.



GMC Jimmie

Manufacturer: GMC Truck Division
General Motors Corporation
Pontiac, Michigan 48053
Base price: $5348—6883
Vehicle type: front-engine, rear-wheel-drive/four-wheel drive
Body styles available: 3-door wagon
DIMENSIONS

Wheelbase	106.5 in
Track, F/R	64.8—66.7/63.4—63.8 in
Length	184.4 in
Width	79.6 in
Height	69.8—72.0 in
Curb weight	3950—4350 lbs
Gross vehicle weight rating	6050—6200 lbs

SUSPENSION

F: 2wd:	ind, unequal-length control arms, coil springs, anti-sway bar
4wd:	rigid axle, semi-elliptic leaf springs, anti-sway bar
R:	rigid axle, semi-elliptic leaf springs

BRAKES

F:	vented disc, power-assisted
R:	drum, power-assisted

EPA ESTIMATED FUEL ECONOMY

City	NA



Jeep CJ5/CJ7

Manufacturer: Jeep Corporation
27777 Franklin Road
Southfield, Michigan 48034
Base price: $5488—5582
Vehicle type: front-engine, rear-wheel-drive/four-wheel-drive
Body styles available: 2-door light truck
DIMENSIONS:

Wheelbase	83.5—93.5 in
Track, F/R	51.5/50.0 in
Length	138.4—147.9 in
Width	59.9 in
Height	67.6 in
Curb weight	2750—2800 lbs
Gross vehicle weight rating	3750—4150 lbs

SUSPENSION

F:	rigid axle, semi-elliptic leaf springs
R:	rigid axle, semi-elliptic leaf springs

BRAKES

F:	vented disc
R:	drum

EPA ESTIMATED FUEL ECONOMY

City	13—17 mpg



Plymouth Voyager Van

Manufacturer: Chrysler-Plymouth Division
Chrysler Corporation
Detroit, Michigan 48213
Base price: $5825—7560
Vehicle type: front-engine, rear-wheel-drive
Body styles available: 4-door van
DIMENSIONS:

Wheelbase	109.6—127.6 in
Track, F/R	67.4—67.9/64.0—65.2 in
Length	179.0-223.0 in
Width	79.8 in
Height	79.0—80.9 in
Curb weight	3550—4300 lbs
Gross vehicle weight rating	4900—7800 lbs

SUSPENSION

F: ind, unequal-length control arms, coil springs, anti-sway bar	
R:	rigid axle, semi-elliptic leaf springs

BRAKES

F:	vented disc, power-assisted
R:	drum, power-assisted

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City	14—17 mpg

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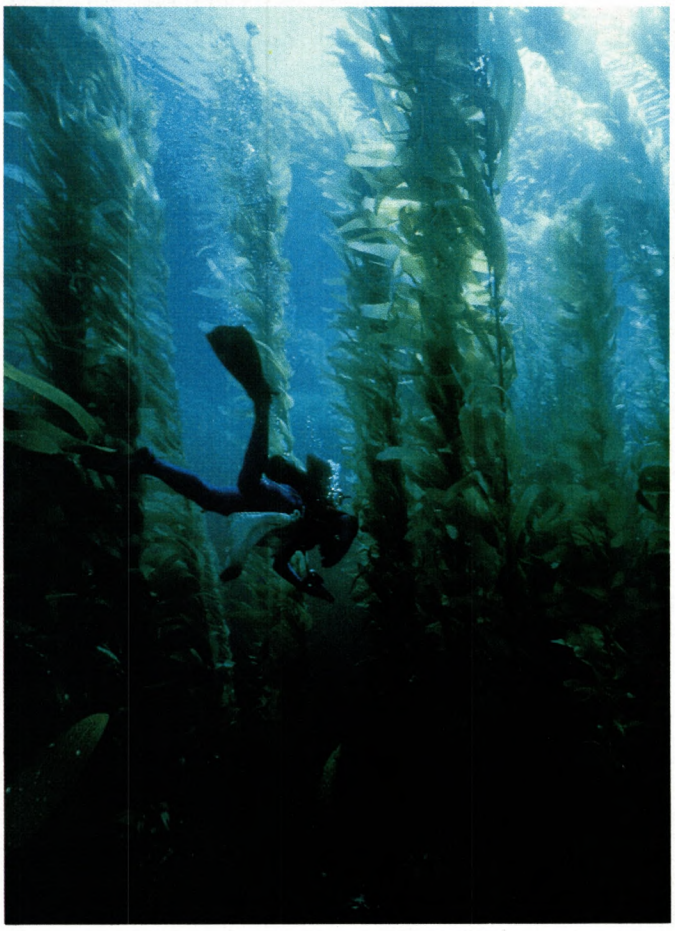
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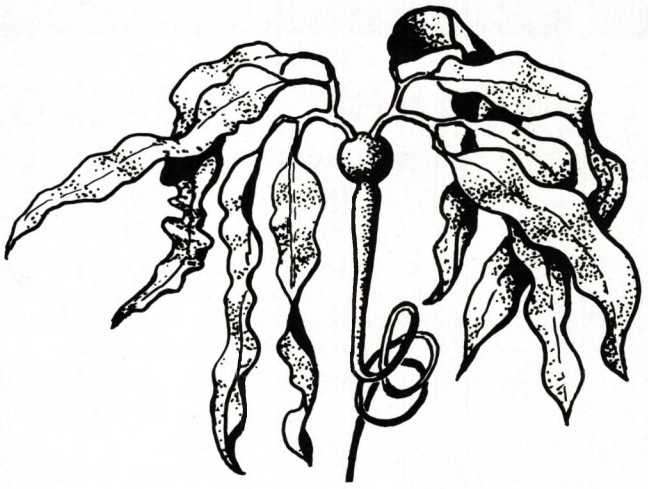
HOWARD HALL

Harvesting giant kelp (left), a California diver is dwarfed by huge ***Macrocystis,*** *a species widely used commercially in the production of algin.*

Kelp Cookery

Delectable and digestible, seaweeds are high in protein and already a part of your diet.

BY PAUL HILL



The notion that seaweed is a last-ditch survival food eaten only by impoverished, isolated primitives has distorted the way Americans view the prospect of eating seaweed. It's true that a taste for some seaweeds has to be acquired, but then the same applies to such land vegetables as beets and spinach.

Seaweeds are a part of the world's cuisine from the subarctic to the subtropics. Seaweeds can be baked, boiled, brined, blanched, fried, steamed, dried, sauteed, or used raw to create dishes which are nutritious and satisfying.

Dulse, a North Atlantic seaweed, has been eaten in Iceland since at least 961 B.C. A law book made in that year refers to the rights and concessions involved before one might collect or eat fresh dulse on a neighbor's land. In Canada dulse is sold in pubs and nibbled with beer as a natural improvement on the potato chip. In Britain laverbread, made with seaweed and oats, is a breakfast treat.

In the Philippines seaweed is cultivated and harvested for the fresh vegetable market. In China, Japan and Korea the cultivation of seaweed occupies practically every usable stretch of coastal water. Their cultivation techniques are probably the most advanced in the world, but still the demand far outreaches supply.

Interest in cooking with seaweeds has been rising in America. The flood of seaweed products reaching us from Japan has stirred public interest. Coupled with the movement towards natural foods it has led to acceptance and even popularity for seaweed cuisine.

Seaweeds are marine algae ranging in size from microscopic to 200 feet long. They are primitive photosynthesizing plants without true leaves, stems or roots. Generally they have a blade that is leaf-like, a stem-like stripe and a holdfast that is somewhat analogous to a root. Some have air bladders for support. The holdfasts are disc- or root-shaped organs which anchor the seaweeds to the sea floor. The holdfast does not absorb nutrients. Instead the seaweeds take nourishment through the entire surface of their blades.

Seaweeds are divided into five groups: Red algae, green algae, brown algae, blue-green algae and yellow-green algae.

Seaweeds grow throughout the world. Most are edible, but only 25 of the estimated 15,000 varieties have commercial value. These 25 find their way into almost every type of prepared food item. It is very unlikely you could consume three meals without eating some form of seaweed. If it weren't for sea-

continued

Paul Hill is editor/publisher of ***Dive Industry News,*** *and author of* ***The Edible Sea,*** *a book considered by divers as the reference for recipes.*

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HOWARD HALL

weed your toothpaste would be chalky, ice cream would not be smooth, pudding would be starchy and the cheese would separate from the noodles in your lasagna. Most of these foods contain thickeners or stabilizers derived from one of the three primary seaweed extracts: Algin, carageenan and agar. Algin is extracted from brown algae, and carageenan and agar come from red algae. All three are jelling agents that have the unique ability to absorb large quantities of water. A tablespoon of algin dissolved in one quart of water will turn the liquid as thick as honey.

Carageenan has as many uses as algin. Carageenan is useful for suspending chocolate in milk, providing instant-meal diet drinks with the smooth bulkiness of a frappe.

In cooking, the seaweed gels can produce any effect animal gels can. Agar will set at room temperature in a matter of minutes. Carageenan and agar-producing red algae can be gathered fresh and boiled in a variety of liquids from milk to fruit juice to produce distinctive gelatins.

Seaweeds are among the most nutritious plants known. In general, seaweeds are high in mineral content and are an excellent source of vitamins. Their content of niacin and vitamins A, E and C compares well with that of green vegetables. Some of the green algaes contain more vitamin B_{12} than liver. Other seaweeds contain more vitamin C by weight than lemons or oranges.

Seaweeds are high in protein; some are as much as 25 per cent protein by weight. Initial digestibility of the protein for an average eater might be 75 per cent, and digestibility increases as

Close-up of giant kelp (left) shows air filled bladders attached to the plant's stipe.

frequency of consumption goes up. Seaweeds are far richer in organic iodine, potassium and other minerals than any land vegetable source. Irish moss contains at least 92 trace elements, some of which are no longer found in land crops.

The only dangerous seaweed is known as *Lyngbya*. It is a scummy-looking growth found matted and floating at the base of mangrove roots. Another seaweed, *Desmarestia*, could cause a serious stomach ache. It is a small brown algae that matures in early summer along both Atlantic and Pacific coasts. It contains sulfuric acid esthers and has a very sour taste.



Dulse ***(Palmaria)***

Dulse is a red algae that grows eight to 16 inches tall. The color varies from rose red to reddish purple. It has a slightly salty, nut-like taste and is delicious. Dulse is found in temperate areas from the tidal zone down to fairly deep water on both the Pacific and Atlantic shores. Dulse can be shredded and stewed in milk as a soup, fried in butter, added to oatmeal or eggs and added to salmon or other fish loaves or casseroles. The favorite use seems to be as a between meal snack.



Laver ***(Porphyra)***

Laver is a red algae that grows to about five feet in length. Its color is steel gray to brownish purple. Laver is found in midtide zones from the polar region to the southern temperate Pacific coastal waters. It is a comparatively tender seaweed and can be used as is or dried like dulse. Saute it in oil with a little teriyaki sauce, then pour it over hot rice. Laver is a favorite of many Indian tribes along the Pacific coast of North America.



Giant Kelp ***(Macrocystis)***

This is a brown algae that is commonly found in water from 20 to 60 feet deep. Its color is a pale olive brown. The base

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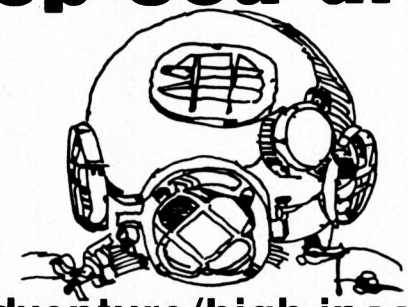
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of each blade has an air bladder. Giant kelp is found on the Pacific coast from Baja to Northern California. It is one of nature's fastest-growing plants (more than 18 inches per day) and the largest marine plant in existence. It has a pleasant, slightly salty vegetable taste. It is used to make commercial kelp products such as pills and powder.



Alaria *(Alariaceae)*

Alaria is a brown algae which may reach 15 feet in length. It is olive brown and has a prominent mid-rib and a group of small blades near the base of the stipe. It grows in the cold temperate to sub-frigid waters of both coasts below the low tide mark. The mid-rib is chopped and added to green salads. It is sweet and crunchy in flavor and texture. The blades can be chopped and used in a stew, soup or pudding. The lower blades can be dried and powdered.



Elk Kelp *(Pelagophycus)*

This is another brown kelp, with a large bladder similar to bladder kelp. However, it grows as far south as mid-Baja. Also the air bladder does not usually reach the surface; its long heavy blades drape over the bottom and hold it down. Two branches grow from the bladder and from these grow the blades. The long hollow stipe and the giant bladder are used to make kelp candy.



Irish Moss *(Chondrus)*

Irish moss is a very common red algae which grows on rocks in the cold, shallow water of the north Atlantic. The color varies from red-purple to a greenish tinge, or white. Irish moss is palatable only when cooked and has a high carageenan content. It is chopped and used in soups and stews as a vegetable and is often used to make a gelatin dessert called blancmange.



Sea Lettuce *(Ulva)*

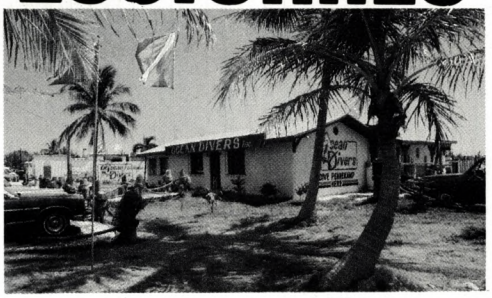
Sea lettuce is a green algae with a wide, yellowish green blade. It resembles

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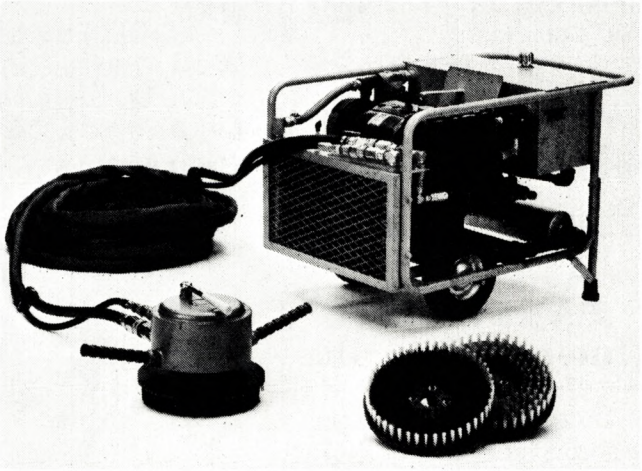
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shiny green plastic, and grows to three or four feet in length. It is found just below the low tide mark in coastal waters all over the world. Sea lettuce can be steamed and eaten, chopped fine and added to salads, or dried and powdered. It is delicious sprinkled over salads or meat dishes when crushed to a fine powder.



Bladder Kelp *(Nereocystis)*

This kelp is brown algae that may grow 150 feet long. It is olive green with 32 to 64 thin blades attached to a hollow bladder at the end of a long, thick stipe. Bladder kelp is found from the northern Pacific to central California. Use only the fresh, crisp plants, not those that are wrinkled. The stipe and bulbs are best used for kelp candy or kelp pickles. The blades, sometimes laden with herring spawn, are tasty only after drying.



Rockweed *(Fucus)*

This is a brown algae common to the rocky North Atlantic shores and tidal zones north of Central California. The plants are olive green and grow to 18 inches. It has a gnarled and knotty look, with a leathery texture. Plants are chopped, dried and used to make tea, which is known as bladder-wrack tea in health food stores. Rockweed adds an excellent flavor when used between layers of food at clambakes.



Sea Palm *(Postelsia)*

This is a very odd brown algae which grows on the northern Pacific coast in shallow water where it is exposed to the full force of the surf. It grows to two feet and is olive green. The stipes are thick and erect with blades hanging from the top like miniature palm trees. The stipes can be steamed, candied, or pickled. The blades can be dried and eaten as snacks.



Eelgrass *(Zosteramarina)*

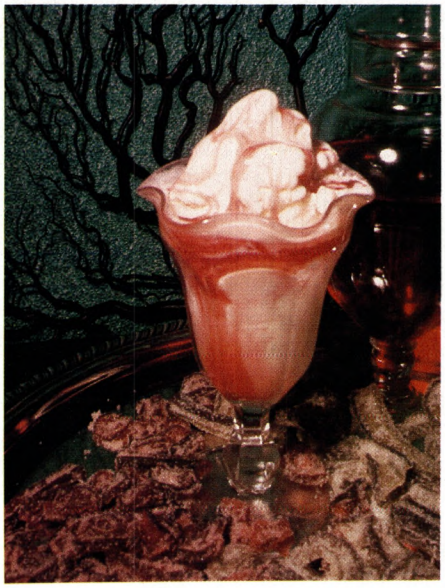
Eelgrass and turtle grass are the only true marine seed plants. These plants

send out long runners to propagate and bear small flowers and seeds. In spring the upper stem of the plant bearing the fruit breaks off and floats on the surface. The grain is harvested in April by Seri Indians along the Gulf of California in Sonora, Mexico. Traditionally they toast it and grind it into a flour. The flour is cooked with water and made into a gruel.

Kelp Candy

Use the stipe and bladder ball of bladder kelp and elk kelp or the stipe of sea palms. Peel the kelp with a potato peeler, then cut into bite-sized pieces. In a large pan, cover kelp with vinegar and boil 15 minutes. Drain, rinse, and soak in water for four to six hours, changing water every hour. Drain when no vinegar can be tasted in the kelp. Use one cup of sugar to each cup of kelp; pour sugar over kelp. Add red food coloring and cinnamon if desired. Bring to a boil, then simmer one hour. Spread a layer of granulated sugar over a cookie sheet or sheet of wax paper. With slotted spoon, dip kelp candy from syrup, drain slightly, and place on the bed of sugar. Roll pieces of kelp in sugar, separating them as you mix, until each piece is well coated with sugar. Place the candy in a single layer on wax paper to cool. Roll again in sugar if desired. Kelp candy is now ready to eat. Store the candy in a covered con-

Using either bladder or elk kelp, the candy recipe also produces a tempting syrup topping for ice cream.



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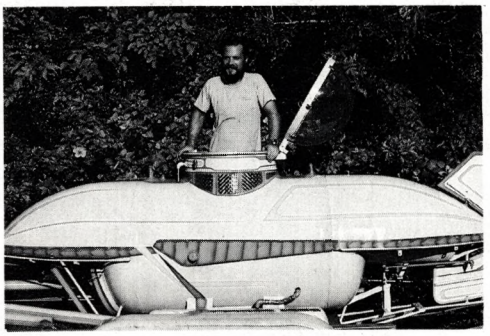
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tainer in the refrigerator and it will keep for several years. The syrup makes a good topping for ice cream.

Kelp Seasoning

The blades of many seaweeds such as sea lettuce, giant kelp and sea palm can be dried and used as seasoning.

Heat oven between 100° and 150° F. Spread seaweed out on a cookie sheet



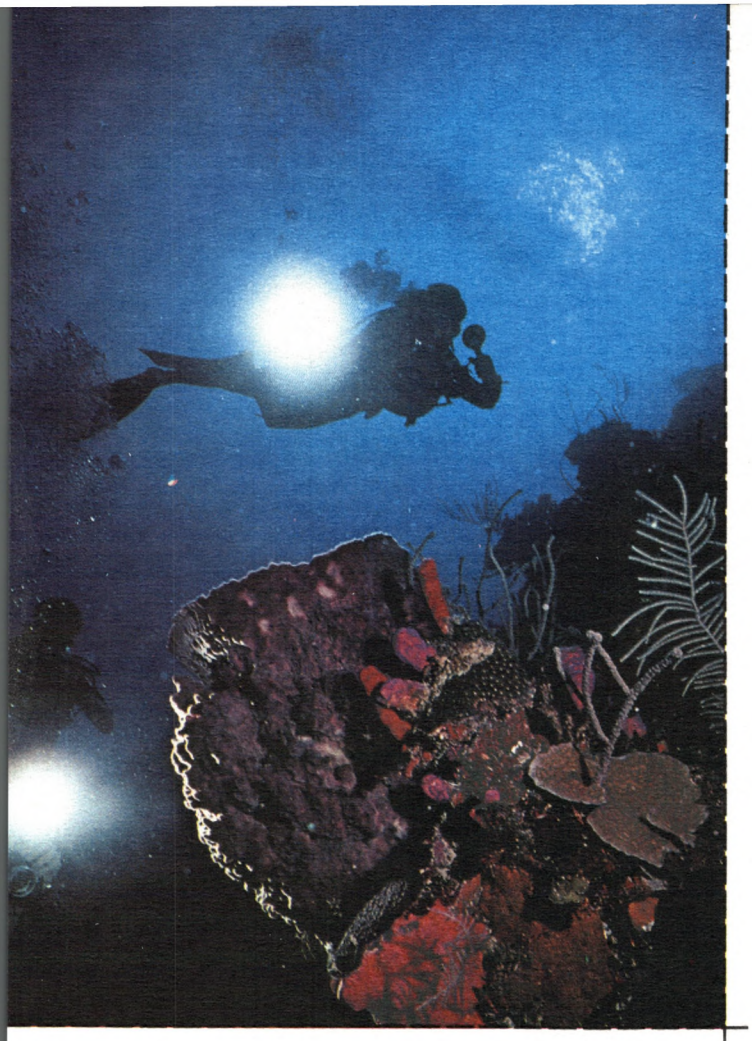


or large flat pan and let it dry in the oven for several hours until crisp. It should be dry enough to crush into a fine powder. Pour through a strainer to remove large hard pieces. Use as a seasoning on salads, fish or meats.

Banana Blancmange

3/4 cup dried Irish moss
1 quart skim milk
1/2 cup honey
1 tablespoon lemon juice
3 ripe bananas

Soak Irish moss in cold water for 15 minutes. Drain and remove any foreign matter. Place in double-folded and tied cheesecloth bag. Place the cheesecloth bag and milk in the top of a double boiler. Bring milk to boil then simmer for 30 minutes. Stir continually. Occasionally press the bag against side of pan to release the gel. Remove the spent bag and discard. Pour the milk mixture into a blender and add honey, juice, and bananas. Blend at high speed. (Other fruit and flavorings may be substituted.) Pour into dessert dishes and cover tightly to refrigerate for several hours before serving.



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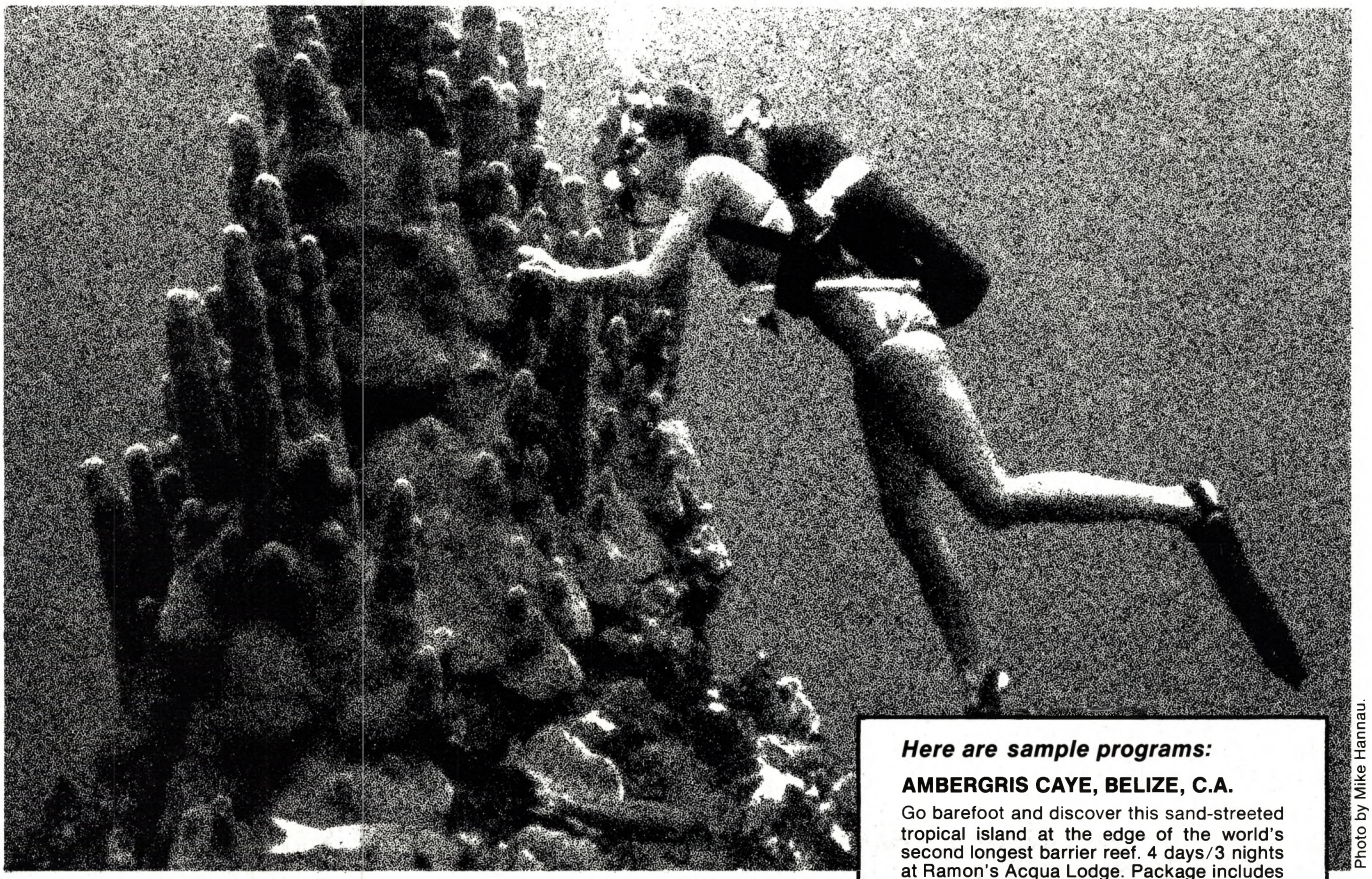


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Lung Control for Longer Bottom Time

Improved breathing patterns can lower air consumption and increase aerobic efficiency.

BY TOM MOUNT

There's a way to squeeze extra minutes from every tank you dive—easily and safely. Techniques used by some divers in the past—notably skip breathing—are dangerous and create an oxygen debt that may eventually lead to blackout. Adapted from a martial art, the method presented here lowers the desire to breathe by recognizing the various stimuli and using each breath to fully satisfy the body's needs. The result is a longer, more comfortable dive.

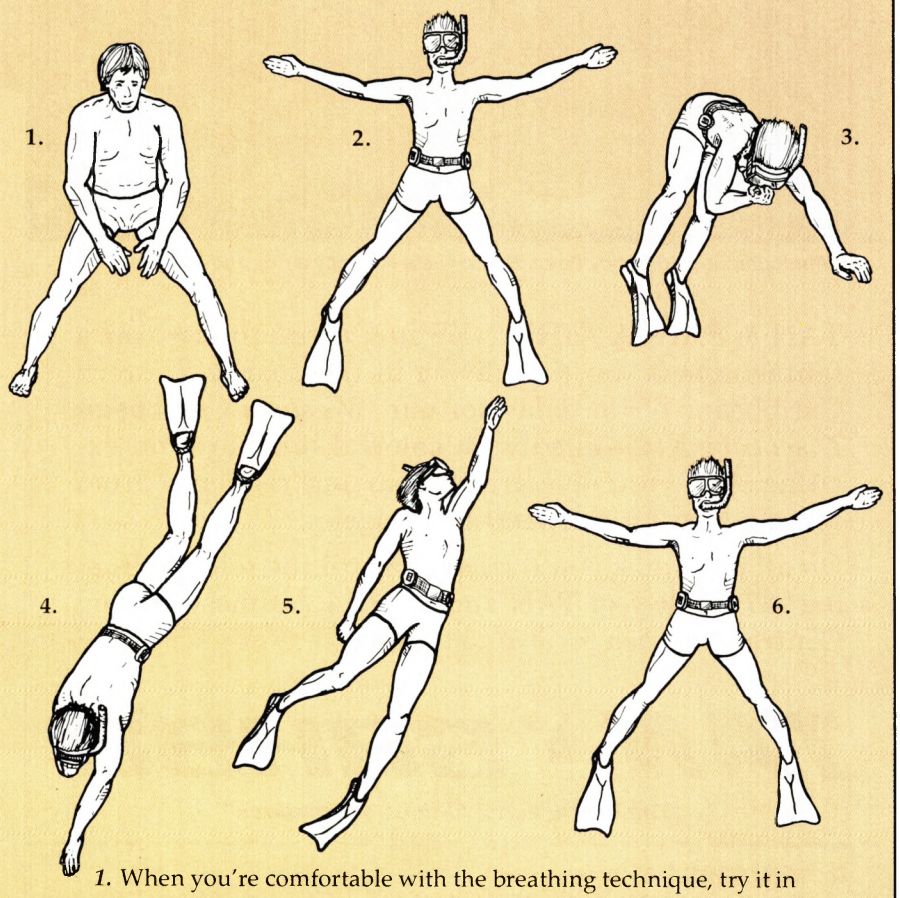
The desire to breathe is activated by several stimuli, only one of which has anything to do with the need for oxygen. Breathing is triggered by: carbon dioxide buildup, muscular exertion, and anxiety or stress. The practice of hyperventilation, used by many free divers, involves drawing several very deep breaths in rapid succession. This temporarily lowers the level of carbon dioxide in the lungs, suppressing the desire to breathe, but at the same time increases stress and muscular stimuli to breathe. Obviously, this approach is at best a compromise, and must be done only in moderation; three or four breaths, with emphasis on exhalation, should be the limit. More could induce unconsciousness. A better advantage could be gained by lowering the carbon dioxide level *without* increasing stress and muscular stimuli. About 900 years ago, the Chinese discovered a way to do it.

Tai Chi is a breathing discipline developed to help the body attain total muscle, and mental, relaxation. Although there are many, the most basic Tai Chi breathing pattern is the easiest and probably best suited for diving. Standing in a relaxed position with your feet comfortably spread, bend your knees slightly, keeping your arms at your side. Now exhale slowly for eight to ten seconds, forcing as much air from the lungs as possible. Without pausing to hold your breath, inhale slowly for the same length of time. Be sure to inhale and exhale fully and slowly, without pausing to hold your breath. Repeat the inhale/exhale sequence five times, concentrating on your lower abdomen.

You may be surprised how relaxed you feel after this exercise. You'll be moving more slowly, using less oxygen and producing less carbon dioxide.

Tom Mount is a past Training Director of the YMCA's underwater activities program and author of ***Practical Diving, Safe Cave Diving*** *and* ***The Cave Diving Manual.***

Tai Chi Freediving Technique

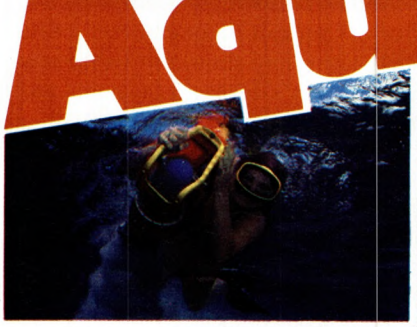


1. When you're comfortable with the breathing technique, try it in shallow water. *2.* Spread out on the surface, relax and breathe deeply and slowly. *3.* Tuck and dive, remembering to equalize mask and ears. *4.* Plug your snorkel and take it easy on the way down. *5.* Look up, reach up and kick slowly for the surface. *6.* Remember to allow at least a three minute interval between dives.

ILLUSTRATIONS: TOM NUIJENS

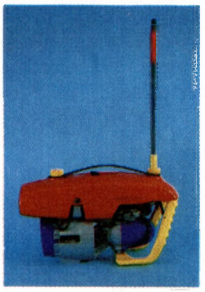
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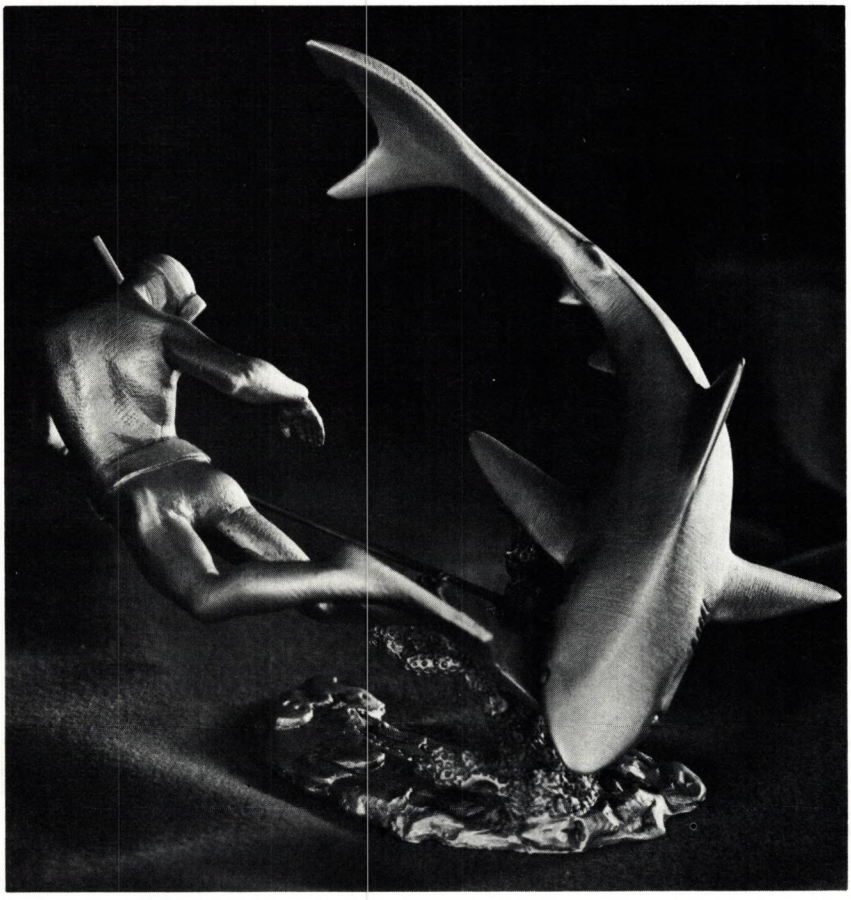
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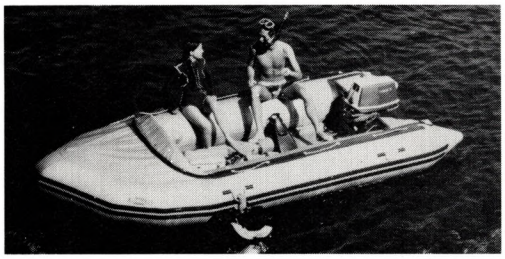
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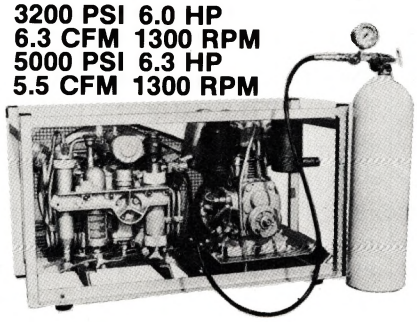
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Free Diving Safety



Free diving can be one of the safest ways to explore the silent world if a few simple safety precautions are observed.

- Limit your underwater time to one and a half minutes.
- Always dive in teams, one diver up and spotting while the other diver is down. Both divers should be capable of achieving the maximum depth being dived.
- Avoid excessive hyperventilation.
- Wear a small CO_2 inflatable vest.
- Spend a minimum of three minutes on the surface between dives.
- If you wrestle down a large fish and are having difficulty getting it to the surface, have your buddy come down and take the fish up. Don't try to gut it out.
- Do not exert on ascent.

Pool Practice

After you feel comfortable with this exercise, try it standing in shallow water with mask and snorkel. Standing on the bottom in chest-high water, bend forward and repeat the breathing cycle five times, breathing through the snorkel. Notice the extra effort needed due to increased pressure on your chest.

To make things easier on your diaphragm, practice the exercise while floating on your back. Bringing your chest up to surface level will reduce the amount of effort expended to breathe, but remember Archimedes' advice; when you exhale you'll lose buoyancy, so try to spread out as much as possible. And remember the key word: relax.

Into the Water

Besides being an exhilarating experience, breathhold, or free, diving using the Tai Chi method of breath control is one of the best ways to condition yourself for longer and deeper dives with compressed air. Breathing skills practiced while scuba diving, such as Tai Chi can stretch your bottom time to the maximum.

When you feel confident in the

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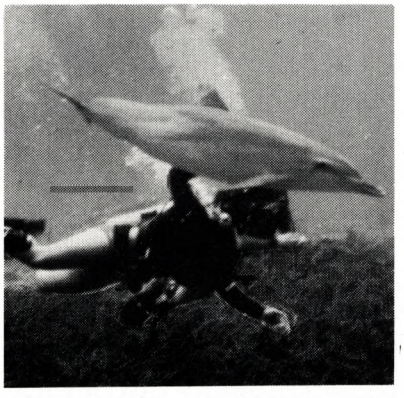
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pool, move your practice sessions to open water. Try a shallow free dive with a buddy, maybe on a reef in 15 or 20 feet of water. Floating on your back, do five cycles of the breathing pattern, then tuck and dive steeply, remembering to equalize your ears and mask. As you begin your descent, plug up the snorkel with your tongue, or remove it from your mouth; the open airway will stimulate the urge to breathe. Don't rush to the bottom, trying to save your air for the reef; that's like writing faster because you're running out of ink. Instead, conserve energy and oxygen by using a relaxed kick. On the bottom, use a lazy dolphin kick or pull yourself along.

Don't gut it out. You'll know when it's time to come up. Look up, reach up and kick slowly toward the surface. Naturally, at this point you'll feel a strong urge to sprint like hell for the sky. But once again, you'll lose more than you'll gain by kicking hard for the surface. As you ascend, decreasing pressure causes a drop in the partial pressure of oxygen remaining in your lungs, making even less oxygen available to your body. Since you'll still be well within safe oxygen and carbon dioxide levels, a slow ascent will get you to the surface feeling much less winded than a sprint that uses up even more oxygen. At five to ten feet, put the snorkel back in your mouth and release a little air into it for displacement clearing as you surface.

Don't tread water when you reach the surface. Spread out face down or on your back, remembering to give emphasis to exhalation. Stay there long enough to fully recover before diving again allowing an interval of three minutes.

Remember that whenever you hold your breath you're creating an oxygen debt that must be repaid. Repeated dives with rest intervals of less than three minutes could cause dizziness or blackout.

At first, these dives will probably be shallow, lasting 30 to 50 seconds. But as you develop your technique and self discipline, greater depths and longer bottom time will come naturally, using Tai Chi techniques or a combination of Tai Chi breathing and careful hyperventilation. Many divers regularly reach 100 feet, and at least one, Jacques Mayol, has reached 300 feet on a free dive. However, these dives are extremes, made by very experienced free divers in top condition. Until you've had specialized instruction and experience, limit your dives to one and a half minutes and don't dive below 40 to 60 feet.

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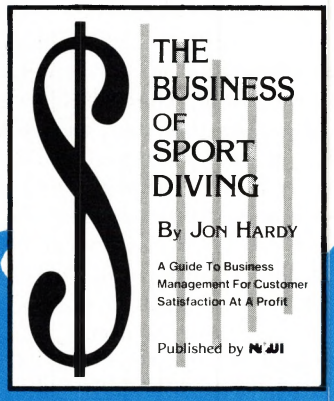
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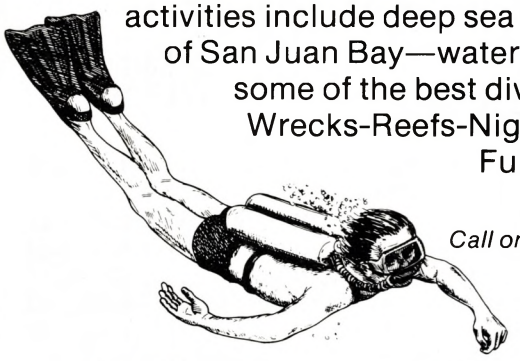
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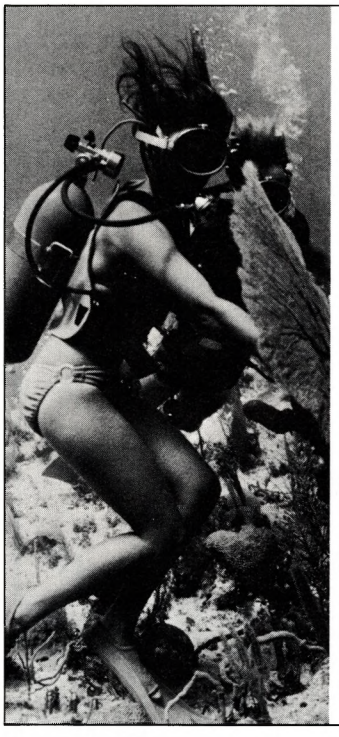
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Free Diving and the Decompression Tables

Under normal circumstances, free diving shouldn't adversely affect your scuba schedule, but there are things you should remember when combining the two. The reason you wait out a surface interval is to allow time for the nitrogen dissolved in your bloodstream to dissipate. If you've just made a decompression dive or a dive that's near the maximum no-decompression limits, then repeatedly free dive to 80 or 90 feet, you could be headed for trouble. The amount of nitrogen added by the free diving is small, but it also interferes with the normal surface rate of nitrogen elimination. This shouldn't be a problem if you avoid deep free dives.

If you want to plan two tank dives near the no decompression limits, and plan to spend most of your surface interval free diving, then limit the number of free dives to allow more surface time. As a further precaution, subtract five minutes from your maximum bottom time on the second scuba dive.

Stay in Shape

Like scuba diving, breathhold diving is its own best exercise. If you're like most divers and can't log enough underwater time to keep in top condition, there are other exercises that can keep you in shape. The most important of these is the Tai Chi breath control exercise. Since it's also a method of meditation, Tai Chi is a good way to relieve tension.

Aerobic conditioning is another good way to tone up. A regular program of jogging or swimming is excellent. Speed swimming on the surface with fins is one way; another is a form of Tai Chi swimming. Fully inhale for five kicks, then exhale for five kicks. If you prefer terrestrial exercise, a program of distance running alternating with short sprints is very effective. This can also be adapted to Tai Chi by inhaling and exhaling at the rate of five paces each.

Aerobic conditioning provided by regular exercise, combined with the Tai Chi techniques, should increase your ability to recognize and control the stimulus to breathe while more efficiently using air consumed. It all adds up to more minutes of bottom time, and a safer, more comfortable dive.

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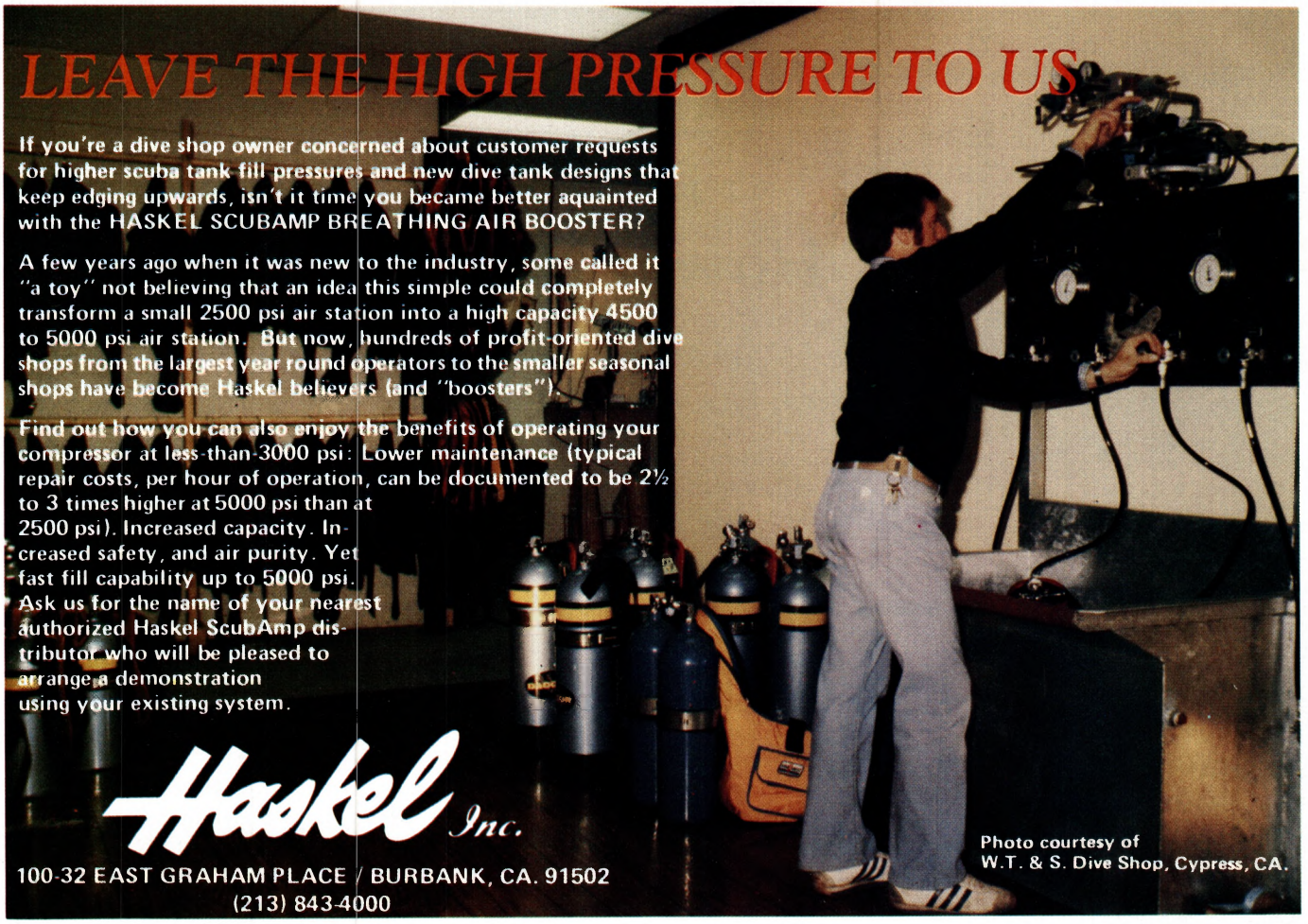


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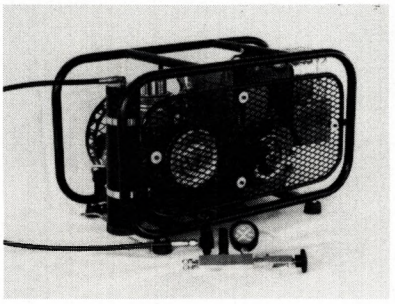


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INSTRUCTOR NOTES

Basic Instruction: How Much is Too Much?

Over-learning can turn off students.

BY LOU FEAD

Basic scuba courses these days are full of trash. What's being passed off as basic instruction is almost incredible. A friend told me she recently took a course which required the following for basic certification: Throw mask, fins, and snorkel into the pool; dive in; don them submerged; and surface with mask and snorkel cleared—all in one breath. Does that prepare novices for basic diving, for fun in diving?

Another woman said in her class students had to do a full ditch and don in 12 feet of water. They took off all gear, including mask and fins, turned off their air, surfaced, went back down, turned on the air, and donned their gear. Now who in hell would ever do that in real life, especially if they've just begun to dive?

This exercise was even more disassociated from actual open water diving by the fact that her instructor wouldn't let her use weights to offset her natural flotation. Could the instructor believe only advanced divers need weights?

Imagine you've just come to your first instructional session. The instructor leads the class to the pool and introduces the course by having everyone tow somebody a hundred yards without warning, warm-up, or swim aids. Half the class is eliminated because they can't do it, and they've been humiliated.

This test they've failed is hardly ever performed even by an instructor, much less a new diver, in real life.

There are many horror tales about instructors making students jump through exercise hoops that have little or no bearing on diving as a sport. Buddy breathing horizontally in a pool for 100 yards without going up and recovering inert divers from the bottom, then towing them to the beach while administering mouth-to-mouth resuscitation are among these.

Instructional litter isn't confined to the water. Many classroom sessions are virtual trash heaps of useless information. Do students want or need to know the names of the laws of gases? Did they pay for a review of high school physics, or to learn to have fun diving?

How does being able to recite the law quantifying expansion of gases and name its discoverer cause a diver to remember not to hold his breath while making an ascent?

Archimedes' Principle, although pertinent to buoyancy control, would work as well by any other name. Still, instructors often require recall of the title for certification. Some even require the students to spell it correctly!

One current exam calls for recitation of trivia when it asks, "What is the pressure in psig at a depth of 100 feet in the ocean?" Who cares about the exact pressure? Does a diver ever get a chance to read it in psig, see it, or feel it? Would knowing the answer make the dive more enjoyable or safer? Would you inflate your vest differently if the pressure were in psia instead of psig?

It hasn't always been like this. There was a time when scuba training was quite simple. There was a short discussion about how to join tank and regulator; breathe from the mouthpiece; clear it, a mask, and your ears; and the warning against breath holding. Some of the more involved training included a few minutes bubbling around in a swimming pool. The new diver then went out with a knowledge of only the basics and perfected his or her diving skills by actually using them. Somehow, the divers survived.

These courses disappeared when the popularity of the sport caused the profession of diving instruction to grow to meet the increasing student load. As instruction became more formal, it also became more complex. Courses expanded to include anything even tan-

continued

Lou Fead is an instructor, author of ***Easy Diver,*** *and has directed several International Conferences on Underwater Education for the National Association of Underwater Instructors.*

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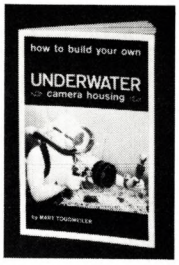
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gentially connected to scuba diving so the students would be safe.

Instructors and their organizations are not guilty of inventing all the rubble found in basic courses. Others have helped. Insurance companies, legal advisers, government agencies, diving councils and equipment manufacturers have demanded inclusion of their own pet subjects in the courses given basic divers. Meeting the requirements envisioned by the whole world has increased training time from hours to days, and is producing a basic diver who knows a lot about everything—except how to have fun underwater. And that's what it's really about, isn't it?

Training time has increased from hours to days, and we're producing a basic diver who knows a lot about everything—except how to have fun underwater.

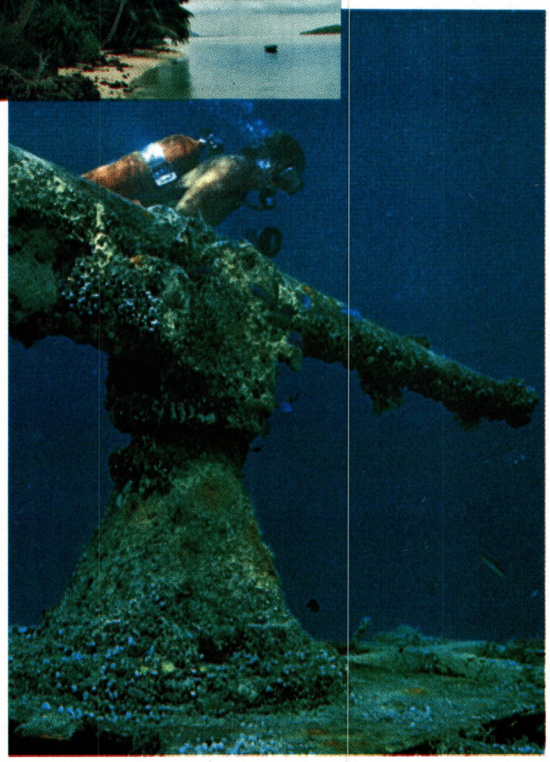
There is one short, simple course still being taught, at the resorts. Today it's not considered complete enough for basic certification. In three hours, portal-to-portal, a resort instructor teaches the student how to breathe; clear regulator, mask and ears; deflate and inflate a vest; look at a submersible pressure gauge; and stay near the guide. The instructor warns against breath holding, then takes the student on a dive.

That's just about the same as the original courses, and it seems to work as well. Many resort students become proficient at routine diving in just a few dives, and they've missed the instructional debris.

Training garbage discourages diving, and makes it unattractive to students. Even I have to teach a lot that's irrelevant in order to meet insurance, legal and professional requirements. That takes the fun out of teaching, so it must do the same for learning.

The time has come to clean house. Let's teach the basics: how to get ready for a dive, how to handle equipment, and how to have fun in the water. Drop out the non-practical parts and fewer divers will drop out. Make the water exercises truly reflect skills needed for ordinary fun diving and sport divers will dive better. And more safely.





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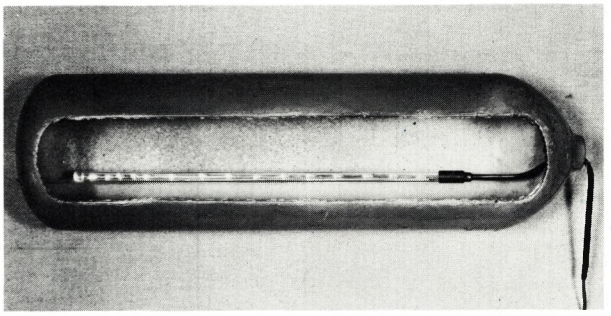
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Nuke Diving: The Hot Bath Treatment



ROBERT SHOUROT

Right: Submerged in hot, radioactive water, a diver repairs the reactor window. Below: Outside the lead shielded access port a diver dons his leakproof suit and dosimeter.

Believe it or not, some people make a living diving inside of nuclear reactors! What they do there is an adventure in itself.

BY C. K. STEWART



ROBERT SHOUROT

There are people who dive in radioactive shielding water surrounding the 4800-degree fuel core of a nuclear reactor. I didn't believe this until I talked to a man who has done it since 1975. I had envisioned a cinematic scene set 100 feet deep in the torrid heart of a nuclear plant; the hero, bombarded by lethal gamma rays, swimming through boiling water toward a core glowing at 5000 degrees for a rescue spectacular.

Robert Shourot was the first diver to work in a nuclear reactor. He's not radioactive and still has all his hair, but the rescues he carries out are real enough.

Shourot, president of Undersea Systems, Incorporated, rescues utility companies from hazardous accidents and costly down time. A small, suntanned man with a gray speckled beard, the 25-year veteran diver saw a need for underwater nuclear power plant maintenance in 1971.

"Diving in nuclear reactors is an entirely new concept. Now there are other people doing it, but we were the first. Using divers saves literally millions of dollars a day in down time." Shourot tossed one of the company's ads on the table. The headline read, "Don't Drain." Draining the large water-filled shielding tanks that house the reactor core takes days, costs millions and releases radionuclides and toxic chemicals into local water bodies. "These tanks average 35 feet deep, but can go over 100 feet," Shourot explained. "The dives take place in these tanks."

Nuclear reactors are designed to create self-sustained, controlled nuclear fissions. This is a process in which an atom struck by a speeding neutron shatters, creating two different atoms and a tremendous amount of heat. This hap-

continued

C. K. Stewart is an avid diver and freelance writer. This is his first contribution to ***Sport Diver.***

pens billions of times per second in a chain reaction. A similar reaction, but purposely uncontrolled, created the atomic blasts over Hiroshima and Nagasaki. In a nuclear reactor the chain reaction is carefully controlled by means of neutron-absorbing control rods. These rods and the reactor fuel, usually uranium 235, form the core of the reactor.

This core produces intense amounts of heat which must be contained and cooled. The core of a commercial reactor operates at temperatures up to 4800° F. Water used as coolant vaporizes into steam which reaches 1000° F.

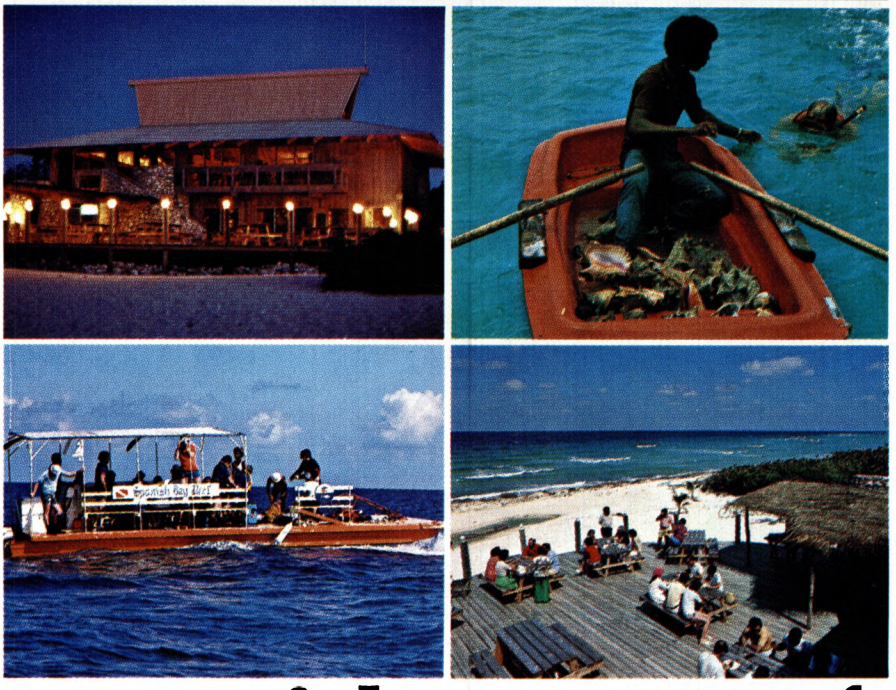
Visualize a hot core inside a cylindrical container. The container sits inside a water tank that holds tens of thousands of gallons. All this is surrounded by a foot-thick concrete container and a separate steel container. High-pressure steam runs through huge copper pipes from the core to the cooling system.

Like all things mechanical, nuclear reactors have a tendency to break down. They require periodic minor repairs, upgrading of equipment and occasional major overhaul. Before Shourot, maintenance required complete draining of the shield water tank. The reactor must be shut down, an expensive and critically hazardous operation. Unlike conventional power plants, a nuclear reactor keeps going after it is shut down unless the fuel is completely removed. Fuel removal can take weeks at a cost of millions per day. Even after it is removed, intensely high radiation levels remain.

Diving repair teams have a serious advantage over conventional maintenance personnel. With water to act as a shield, divers can remain longer in the vicinity of the core. In a dry tank, maintenance personnel must be rotated after only a few minutes to keep radiation exposure levels within safe limits.

Shourot began training divers for nuke dives in 1971. His techniques were first put to test in 1975 when refueling equipment for a nuclear generator jammed in a New York plant. During the first 20-minute dive, Shourot found a jammed pulley. He also observed that the entire fuel transfer assembly was badly deteriorated due to highly corrosive conditions in the reactor. The jammed equipment was freed during a second 20-minute dive. Later the refueling equipment was completely overhauled as a result of Shourot's findings.

Nuke diving is not without risk. Radiation poses the most danger. Even after shut-down, the reactor remains



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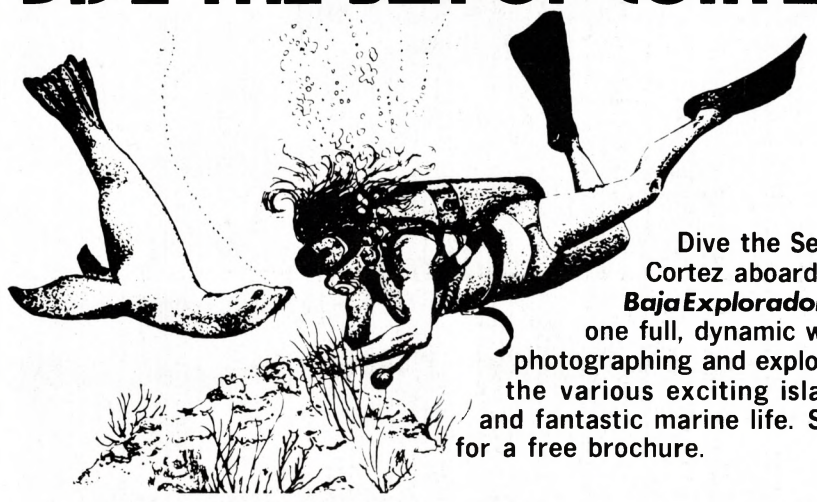
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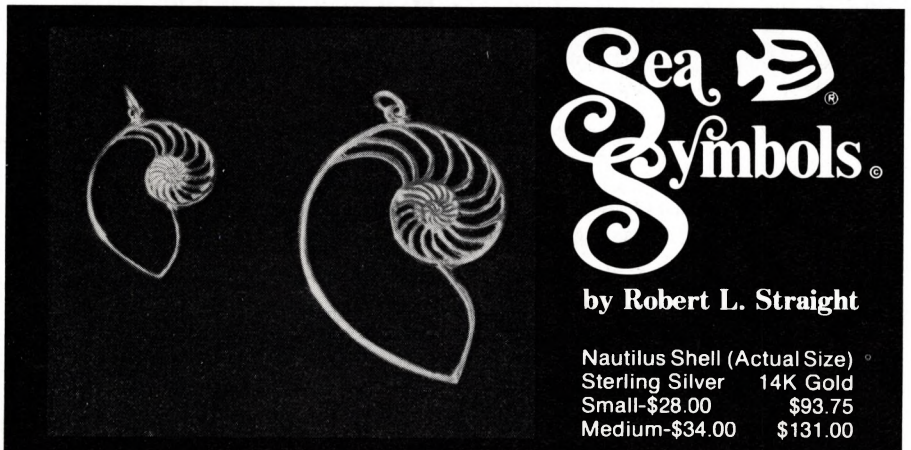
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highly radioactive. Water in the shielding tank maintains a constant 120° F. temperature and contains toxic chemicals and radioactive particles. Shourot's team wears leak proof dry suits. Dosimeters record the amount of radiation exposure accumulated during each dive. Alarm devices called "chirpers" emit a series of beeps that quicken as the radiation level increases. Shourot's team carries TV cameras, still cameras, underwater communication systems, equipment for surface-supplied air, customized tools and a portable recompression chamber.

The team recently worked in a smaller experimental reactor in Albuquerque, New Mexico for Sandia Laboratories. This job required upgrading the research reactor so that it could be used to simulate radiation effects produced in a breeder reactor. Breeders are reactors which produce more fuel, in the form of plutonium, than they consume. The six-man Sandia team earned $25,000 for three weeks' work.

Shourot's team of eight nuke divers absorb "very minimal" amounts of radiation due to a technique developed by Shourot over a period of three years. The Nuclear Reactor Diving System is a combination of carefully rehearsed teamwork and state-of-the-art equipment. Usually working one or two at a time, divers in a reactor tank are watched by topside tenders on a television monitor, keeping track of the divers' radiation exposure. Through a radio communication system, the tenders can "guide divers around the hot spots" and warn them when exposure levels are increasing. Specially designed tools enable divers working on critically "hot" components to stay behind a lead shield, working around the shield and seeing the job through a television monitor.

So far the system has proven safe; there have been no accidents, Shourot says, "not even a close call."

But how must Shourot have felt just before that first dive, knowing he'd be swimming scant inches from a 5000° nuclear fuel core in hot, poisonous water; knowing no one had ever done it?

"I knew the risks, and I had confidence in my equipment and my technique. But, yeah, standing by the reactor pool suiting up I was a little apprehensive. After I got wet, though, I didn't have time to think about it. It hasn't bothered me since then."

Scared? "Never."

Shourot laughs. "Well, I glow a little bit, but I feel just fine."

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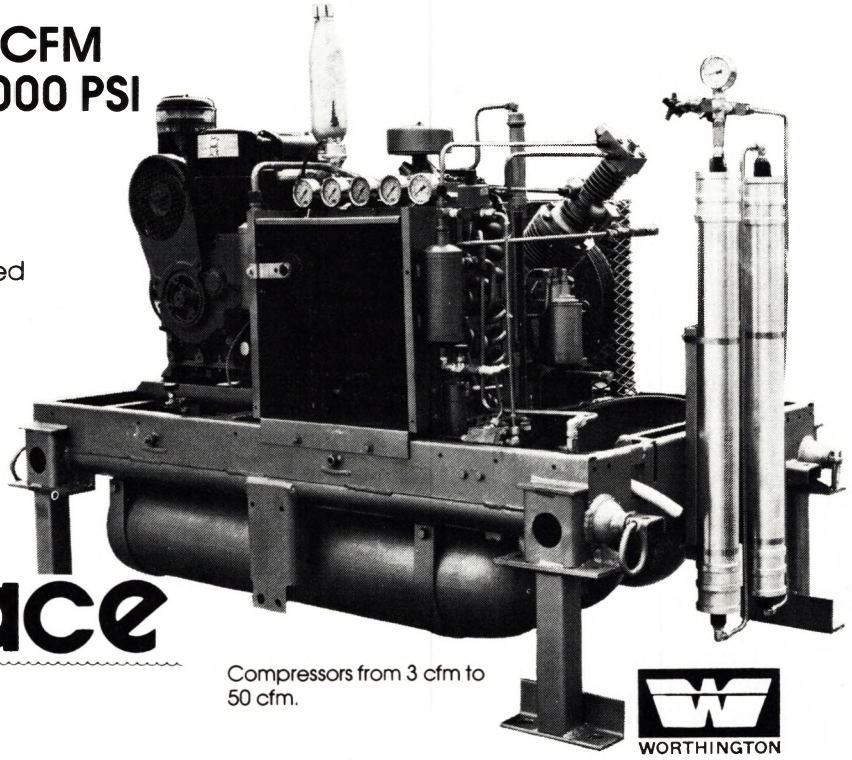
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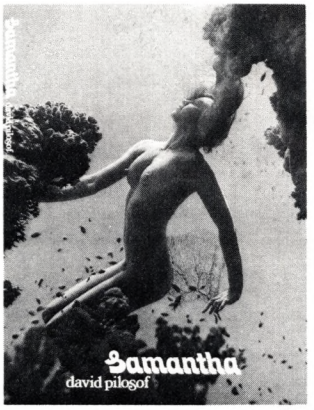
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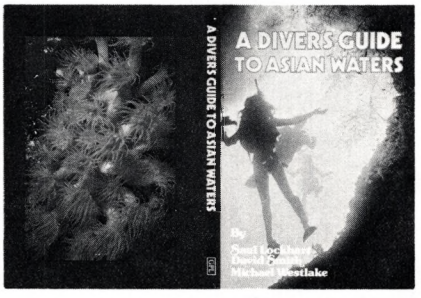
Samantha
David Pilosof; H. Lonay & D. Pilosof; Hardbound; 148 pages; $25.00

Although photographs of nudes underwater have long been accepted and sought after in Europe, they have not been the norm for American diving publications. They are seen so rarely here that David Pilosof's *Samantha* seems a little overwhelming—an entire 148-page, 9 inch by 13 inch, full color, high quality book devoted to photographs of a single woman.

Pilosof, an Israeli, found his model, Samantha, in London. He flew her to the Red Sea, and introduced her to diving and underwater nude modeling simultaneously. She does not wear tanks, or anything else. Samantha is photographed in close contact with the natural Red Sea environment—brilliant corals, gorgonians and fish.

The reproduction is excellent, on high-quality stock; a very attractive package. The design of the book is modern and clean, many of the photographs are full page size. The text, which concerns Samantha's relationship to her new aqueous playground is sparse and does not visually intrude.

A Diver's Guide to Asian Waters
Saul Lockhart, David Smith, Michael Westlake; Gareth Powell Ltd.; Softbound; 202 pages; $15.00



This excellent guide covers the diving sites and logistics of reaching areas throughout the Philippines, Malaysia, Singapore, Indonesia, Hong Kong, Thailand, Taiwan, Guam, and Micronesia.

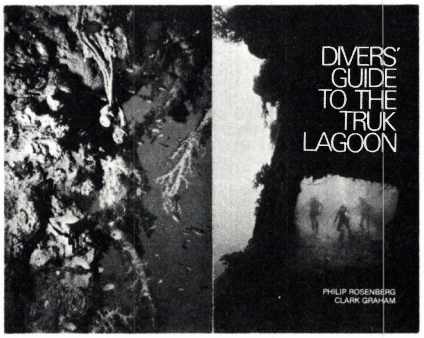
Each area is covered in a separate chapter with descriptions of topside and under-

water scenes, lists of facilities and sites, and a collection of contacts and addresses.

The authors are all British Sub-Aqua Club divers and instructors who live in Hong Kong. There are 152 color photos illustrating the best sites of each area and appendices covering marine life of the regions, decompression tables, and a bibliography.

The book is available through Gareth Powell Ltd., 17 Thompson Road, 11th floor, Wanchai, Hong Kong.

Divers' Guide to the Truk Lagoon
Philip Rosenberg, Clark Graham; Softbound; 55 pages; $5.00



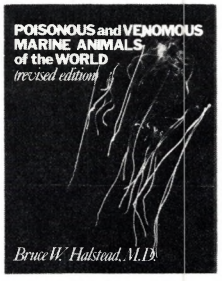
In the western Pacific, seven degrees above the equator lies Truk Lagoon. This reef-encircled body of water holds 11 islands, and they have become a mecca for wreck divers around the world. In February and April of 1944, the U.S. Navy conducted air attacks here that resulted in the sinking of over 50 ships of the Imperial Japanese Navy.

Many of the ships lie in relatively shallow water, and as they are part of a marine preserve, contain an abundance of artifacts. In addition, there are several airplanes and a submarine in the Lagoon.

The *Divers' Guide* locates the shipwrecks on a map, names and describes each one, giving its size, type, depth, position, heading, and notes on the condition of the hull, diving conditions and special sights.

The book is well illustrated with 11 color photographs, two black and white photographs, and drawings of each vessel.

Poisonous and Venomous Marine Animals of the World
Bruce W. Halstead, M.D.; The Darwin Press; Hardbound; 1,326 pages; $65.00



Dr. Bruce Halstead is Director of the International Biotoxicological Center, World Life Research Institute, in Colton, California. This book is the revised, updated edition of

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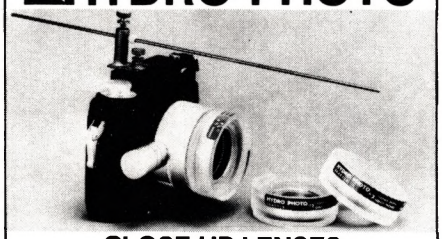
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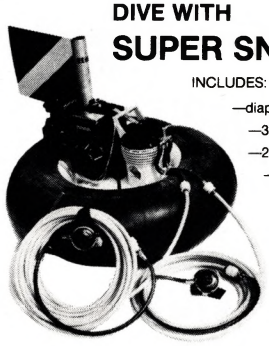
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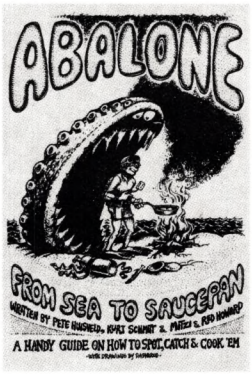
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a work which was 30 years in the making, and has become the standard reference on venomous and poisonous sea creatures.

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The information is contained in slightly over 1000 pages of text which incorporate more than 300 photographs, drawings and graphs, 23 tables, 13 maps and covers 550 species. In addition there are 280 pages of plates with 640 photographs and illustrations, both color and black and white.

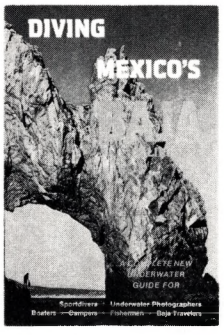


Abalone From Sea to Saucepan
Pete Husiveld, Kurt Schmitt, Mitzi Howard; Tofua Press; Softbound; 80 pages

Twenty-five recipes for abalone meat highlight this humorous diver's-eye look at California's favorite shellfish.

Notes on the natural history and ecology of the abalone, along with California state game regulations pertaining to harvesting are included.

Seven color photos and a number of cartoons and diagrams illustrate the more common species.



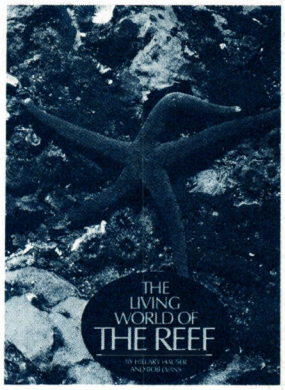
Diving Mexico's Baja California
Michael Farley, Lauren Farley; Marcor Enterprises; Softbound; 176 pages; $6.95

This convenient handbook is what its title professes—a guide to diving the Baja. Both the Pacific and Sea of Cortez coasts are included in the list of over 200 diving locations. Depths, water entries, visibility, wreck sites, currents and local marine life are described in detail for each of the sites.

In addition there is updated information on the documents you'll need, auto insurance, gas stations, fish and game licenses,

ferryboat service and travel hints. There's even a diver's Spanish glossary with such hard-to-find-and-translate words as wet suit, dive shop and the like.

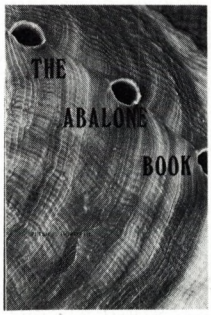
The Living World of the Reef
Hillary Hauser, Bob Evans; Walker Publishing Co.; Softbound; 96 pages; $6.95



This book is a descriptive and photographic study of California's reef communities.

The text describes animals typically found on the reef and places them within the context of reef ecology. There are 39 color and 53 black and white photographs of reef scenes, the ocean, and reef inhabitants.

In addition there is an identification guide which describes each animal in more detail, giving its common and scientific names, its habitat and habits.



The Abalone Book
Peter Howorth; Naturegraph; Softbound; 80 pages; $3.50

If you're an abalone aficionado, this is your book. Exploring the natural history of the gastropod as well as its history of use by man, the abalone's life cycle, environmental requirements and commercial fishery potential are fully explicated.

Eight color plates show both above and below water views of the different species of abalone, concentrating on the shell and the fringe of skin around the animal's foot, which is a prime feature for species identification.

Author Peter Howorth has been diving for 24 years, including 12 years as a commercial abalone diver and two years as manager of an abalone processing plant.

The book's final chapter deals with preparing the abalone for consumption, listing 11 recipes.

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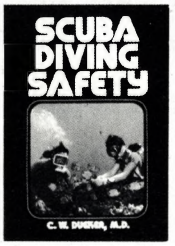
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LOCATION—Secluded resort location on west side of island directly on the ocean, one-half mile north of Cockburn Town on San Salvador Island. One-quarter mile from San Salvador Airport.

TRANSPORTATION—Air: Bahamasair from Nassau and Miami to San Salvador, Columbus Landings Air from Ft. Lauderdale. Private flights can land at San Salvador Airport's 4500-ft lighted airstrip with ESE approach. Ground: transfer from airport included in rates and provided by the hotel. Car, boat, and motorcycle rentals available.

ACCOMMODATIONS—Twenty-four double rooms in the hotel have poolside or ocean view. 5 cottage-style villas feature refrigerators and terraces. All guest rooms include private bath, shower, air conditioning. Resort has eighteen miles of sandy beach and all buildings are within walking distance of the marina and sport facilities. Complete resort facilities include dining room, Driftwood Lounge with entertainment, freshwater swimming pool, tennis court marina with six berths, Airport paved, call Unicom 122.8, LF BN frequency is 281 mc. Rates: single room for $54 (Full American plan), double room for $78 (Full American plan). Ocean- side cottages: double for $84 (Full American plan). Each additional person $28. Children under eleven years $23. Only Visa and Master Charge credit cards accepted.

DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **yes**	Drift dives **no**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **yes**	Beach dives **no**

DIVING EQUIPMENT—Ingersoll-Rand compressor, 5000 PSI. Two hundred and ten tanks, each seventy-two cubic feet. Four 34-foot tri-hull flat-top sun cover dive boats with a total capacity for seventy-two divers. Limited retail sales available. Rental equipment includes tank $8/day, regulator $7/day, mask/snorkel $1/day, underwater light $5/day, underwater camera $15/day, flash $10/day. Complete photography lab and workshop on site, includes air conditioned 1500 square foot building with individual workbenches, lights and storage. Classroom has ten by twelve foot projection screen and complete audio-visual equipment. Darkroom for E-6 processing has temperature controlled plumbing, water softening apparatus and special filters. Film in stock, twenty-four hour photo finishing available for $6.50/strip

DIVING SERVICES—PADI, NAUI, NASDS, SSI, YMCA affiliation. Five star PADI training facility. Six instructor divemasters. Resort course $75, full certification $160, advance courses $50, photo coaching $25, one day introduction to photography $50, basic photo course $100. First aid/CPR trained. Cost for one-half day diving $22 includes two dives, cost for full day diving $38 includes three dives, cost for night dive $16. Tank/bac pac, weights included in dive. Dives are all pre-planned to insure maximum time underwater. Dive boats are one hundred and fifty yards from rooms. Dive sites are only five or ten minute boat ride from dock. Sites include Pillar Reef, Riding Rock Wall, Cathedrals, Movie Caves, Cable Drop Off, Hamlet Holes and Grouper Gully.

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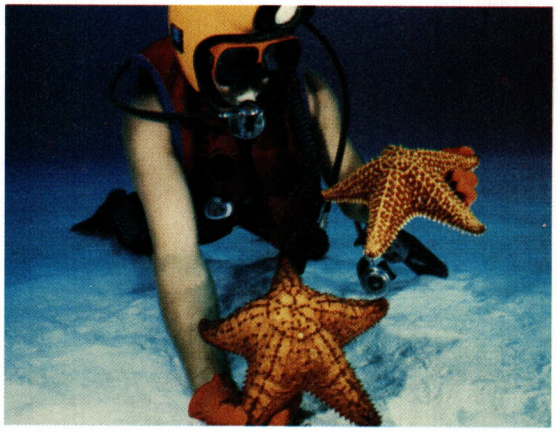
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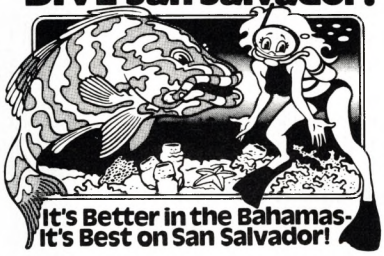
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LOCATION—Situated on the water in Lucaya, one-quarter mile from the ocean in the Lucayan Bay Hotel complex. Six miles from the airport.

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ACCOMMODATIONS—Seventeen major hotels in Freeport/Lucaya ranging from economy to luxury with 2,000 rooms. Many with oceanview, private balcony. Casino gambling in Freeport. Major credit cards accepted at hotels.

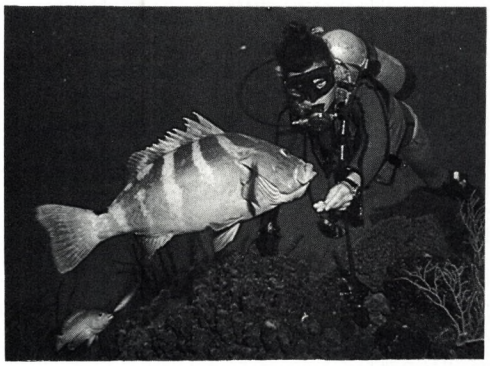
DIVING AVAILABLE—

Shallow reef (5'-33') **yes**	Walls **yes**	Drift dives **yes**
Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **yes**	Beach dives **no**

DIVING EQUIPMENT—Twin Ingersoll-Rand compressors, 3500 PSI. One hundred and thirty 72 cu/ft tanks, two boats include 42 ft Thomas with a 42 diver capacity. Full retail sales. Dive complex includes 18-ft training pool, museum, recompression chamber, health club, photo darkroom and lounge.

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ACCOMMODATIONS—Several campgrounds in area include Bahia Honda State Park and Big Pine Key Fishing Lodge. Local motels range from economy to full service with restaurants, lounges and pools. Rates range depending on facility. Major credit cards accepted.

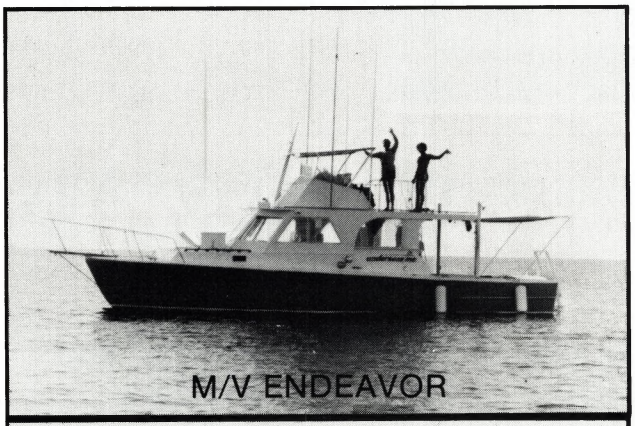
DIVING AVAILABLE—

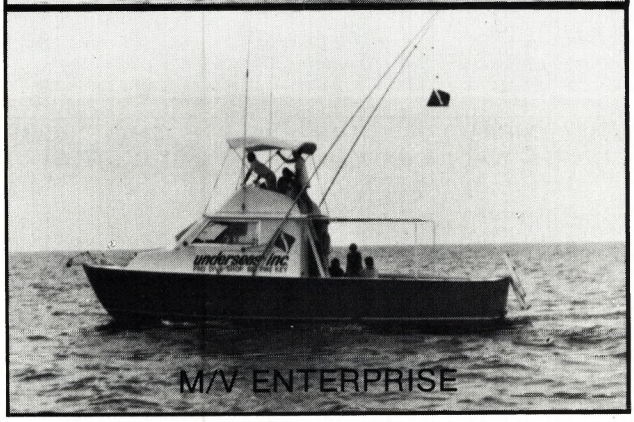
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Mid reef (33'-66') **yes**	Wrecks **yes**	Night dives **yes**
Deep reef (66'-99') **yes**	Caverns **no**	Beach dives **yes**

DIVING EQUIPMENT—2 Worthington compressors, 5000 PSI. 75 tanks. Three diesel powered fiberglass custom boats built specially for diving. Includes a 40' long range cruising boat which sleeps six in comfortable bunks for daily and nightly trips to LOOE KEY REEF. All boats equipped with single side bands, VFH & CB radios, two fathometers, large enclosed heads, stereos, staircase boarding ladders, U/W speakers, twin engines, air compressors, 13' utility boats. Available for night and day reef trips and specialized charters. Full service retail store has complete line of diving equipment for sale and rental. Film in stock. U/W camera $7.50/day.

DIVING SERVICES—PADI affiliation. 2 instructors/2 safety assistants. Full certification $150. Cost/half day $15 for 2 dives, full day $20 for 3 dives, night dives $25.

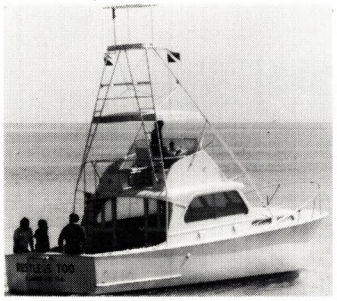
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2 freshwater shower • cushioned seats w/individual tank and gear storage • walk-out transom • platform • 2 ladders
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Dive Center: (305) 743-5929 • Motel: (305) 743-9474
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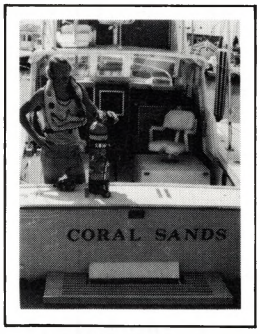
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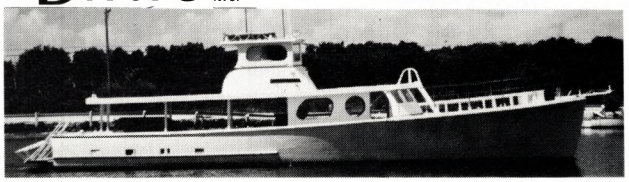
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3 Locations



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see our ad page 175
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SUN DIVERS STATION, *RT #3 BOX 289A, KEY LARGO, FL 33037*

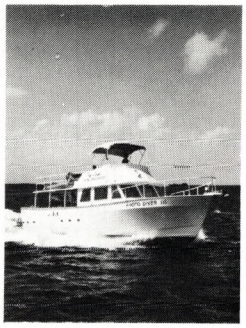


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The 1st New-True 60 ft Dive Boat On The East Coast

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The Pro Dive Stores below are listed by state, then alphabetically by cities and store name within each city. To advertise your professional services in the directory, send $80 check or money order, with listing information to Pro Dive Store Directory, c/o Norman Hamilton, 444 Brickell Ave., Suite 250, Miami, Florida 33131. Prepayment will expedite materials and assure your listing. Tell divers where you are, what you offer, and that you want to do business with them—list your facilities in the Pro Dive Store Directory.

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(907) 225-5020, 225-DEEP

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Arizona's most active dive Center-NASDS
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(602) 995-5926 or (602) 275-1221
616 S. Myrtle, Tempe, AZ, 85281

Aqua Sports, Inc.
First pro dive shop in Arizona. Original owners since 1955.
4230 E. Indian School Rd., Phoenix, AZ
(602) 955-4120

ARKANSAS

Scuba Hut-Sportsco
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1115 S. Hwy. 71, Springdale, AR 72764
(501) 751-0636

CALIFORNIA

California Skin Diving School
1083 N. Harbor Blvd., Anaheim, CA 92801 (714) 991-DIVE; 9762 Magnolia, Riverside, CA 92503 (714) 689-2422; 1173 N.E. St., San Bernadino, CA 92410 (714) 885-1416; 4420 Holt Blvd., Montclair, CA 91763 (714) 621-4171

Scuba Schools of Anaheim/Long Beach/Oceanside Classes-Equipment Sales-Repair-Rental. 1640 W. Lincoln, Anaheim 92801; (714) 956-5540; 4740 P/C Hwy., Long Beach 90804; (213) 433-6765; 129 South Hill, Oceanside 92054; (714) 722-2455

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PADI 5 Star training facility. All major brands. Complete professional in-house repair. Tour Channel Islands. Open 7 days. 3000 psi-Sales-Rentals-U/W Photography.
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(805) 484-1594

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10950 S. Mt. Vernon, Colton, CA 92324
(714) 825-2502

Divers Corner
11200 Old River School Rd.
Downey, CA 90241
(213) 927-1417

Ocean Sports, Ltd.
NAUI-PADI-Sales-Rentals-Repairs-3000 PSI-Air-Trips.
16446 Bolsa Chica, Huntington Bch., CA 92649
(714) 840-4840

Laguna Sea Sports
925 N. Coast Hwy., Laguna Beach (714) 494-6965; 1951 Newport Blvd., Costa Mesa (714) 645-5820; 7066 Van Nuys Blvd., Van Nuys (213) 787-7066; 18503 Hawthorne Blvd., Torrance (213) 542-8609; 3335 Motor Ave., W. Los Angeles (213) 559-7771

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Open 7 Days-NAUI-PADI Certification
11830 W. Pico, Los Angeles, CA (213) 477-5021; 3860 Rosecrans, San Diego, CA (714) 298-0531; 8363 Center Dr., La Mesa, CA (714) 462-4570

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(408) 375-1933

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Divers Down—San Fernando Valley
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6742 Reseda Blvd., Reseda CA 91335
(213) 342-1212

Scuba Duba Dive
12538 Ventura Blvd., Studio City, CA 91604 (213) 761-7833; 7126 Reseda Blvd., Reseda, CA 91335 (213) 881-4545

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Will Jacobs Dive Shop
Sales-Service-Rentals-Hydro-Instruction.
1153 New Britain Ave. W., Hartford, CT 06110. (203) 232-8719.

Jack's Dive Center
Sales-Service-Instruction-Rentals-5000 psi air-Trips-Photography & Commercial Equip.-AGA Divator. Rt. 10, Plainville, CT 06062
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(305) 737-7240

Gulfview Divers Headquarters
Air-Rentals-Sales-Underwater Photography-Hydro testing-Pool on premises-Dive trips-PADI Inst. 101 Bridge St., Bradenton Beach, FL 33510. (813) 778-3735

Charlotte Diver
Sales-Service-Rentals-Lessons-Air
861 S.E. Tamiami Trail, Charlotte Harbor, FL 33950. (813) 629-2722

Herb's Dive Shop
Reef Trips-Scuba Tours
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(904) 253-7221

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(305) 852-5498

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Sales-Service-Rentals-3000 PSI Air-Camping RV Hookups-Excellent Visibility yr. round-Cave/Cavein Diving-Compressor/Cascade sales
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Daily reef trips on 48' custom dive boats-Air-Sales-Service-Scubapro-Dacor. come join us for full day of diving. 301 E. Blue Heron Blvd., Riviera Beach, FL 33404. (305) 848-7632

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Scuba Instruction-Resort Courses-Rentals-5000 PSI-Air Station-Daily reef and wreck trips-Several custom boats available, including 37' for large groups. 3619 Broadway, Riviera Beach, FL 33404. (305) 844-DIVE

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(305) 872-2400

The Dive Shop, Inc.
Diving gear and instruction-Surf shop-Hobie sail boats-Trips in Florida to the Bahamas.
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Dive and Leisure Sports
PADI Training Facility-Monthly Dive Trips.
3365 Main Street, College Park, GA 30337
(404) 767-1815

Outdoor Adventures Unlimited
Sales-rentals-service-PADI Instruction - 5000 psi Air-Dive trips-Group rates
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Call or write today—(912) 745-6441

Sub-Aqua Specialties
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1-800-342-7156 (GA); 1-800-841-4443 (others).

HAWAII



South Seas Aquatics
1125 Ala Moana Blvd.
Honolulu, Hawaii 96814. (808) 538-3854

Aaron's Dive Shop, Inc.
Plane work-Charters-U/W Scooters-Shelling-Our guides capture your dive on film-NASDS-Full Service Store-Instruction.
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Central Pacific Divers
Daily Charters to the Best Diving on a choice of 6 islands-Sales-Charters-Instr.
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74-5484 Kaiwi St., Kailua Kona, HI 96740

Hawaiian Divers
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Charters-Air-Gear
Box 572, Kailua Kona, HI 96740
(808) 329-3407

Aloha Dive Shop
"Gateway to Hanauma Bay"
Retail Sales-Service-Air-Rentals - Charters-Boat & Shore Dives-Inst. Koko Marina, Hawaii Kai, HI 96825. (808) 395-5922

Sea Sage Unlimited
"Kauai's Only Complete Pro Dive Ctrs."
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"The Best on Oahu"-Daily dive tours-Complete dive center for novice/pro-5 day certification course. 1382 Makaloa, Honolulu, HI 96814
(808) 941-2284

ILLINOIS



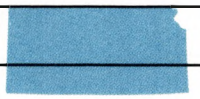
Academy Aqua Sports Dist. Ltd.
Air-Sales-Service-Instruction
2838 Chicago Rd., S. Chicago Hts., IL 60411
(312) 756-4334

Underseas Scuba Center
Sales-Service-Instruction-Trips
226 South Main St., Lombard, IL 60148
(312) 629-2534

Midwest Diving Specialists, Inc.
Dacor-Global-Ikelite-Imperial-Poseidon - White Stag-PADI Inst.-Air. 203 S. Linden, Normal, IL 61761. (309) 452-0222

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315 W. Ogden Ave., Westmont, IL 60559
(312) 917-1060; 6932 W. 16th St., Berwin, IL 60402 (312) 484-1018

KANSAS



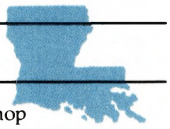
Topeka Dive Shop
NAUI-PADI-Air-Tours
Stauky Marina on Beaver Lake Arkansas.
1425 Lane, Topeka, Kansas 66604
(913) 357-4895

KENTUCKY



Lexington Dive Shop, Inc.
Everything in diving.
819 Euclid Ave., Lexington, KY 40502
(606) 266-4703

LOUISIANA

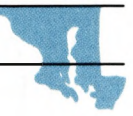


Underwater World Dive Shop
(Bob and Terryl Noe)
PADI Instruction-Air-Rentals-Service-Dacor and Scubapro Sales. Toledo Bend Marina, South Toledo Bend Lake. 602 W. North St., Leesville, LA 71446. (318) 328-1368

Harry's Dive Shop, Inc.
Skin-Scuba-Commercial Equip.-Sales-Service-Repairs-Airfills-USCG Cert. Dive Boat.
4709 Airline Hwy., Metairie, LA 70001
(504) 888-4882

Adventure Sports
NAUI-YMCA-PADI Instr.-Home of ARK-LA-TEX Diving School Inc. & U/W Swim Assoc.-Sales-Repairs-Rentals-Air-Trips
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(318) 425-5870

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Commercial and Sport Diving equipment
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(301) 655-8744

Port Hole Dive Shop
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Baltimore, MD 32055. (301) 363-3388

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Maryland's largest full line pro dive store.
Instruction-Charters-Travel-Service
7649 Crain Hwy. S, Glen Burnie, MD 21061
(301) 761-4520

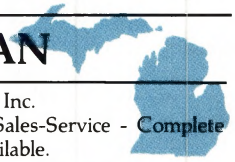
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(617) 453-7574

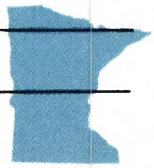
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Holly Scuba Center, Inc.
Instruction-Rentals-Sales-Service - Complete activity program available.
3525 Grange Hall Rd., Holly, MI 48442
(313) 634-5913

Lake Orion Divers Den
Air-Sales-U/W phot-PADI Instruction-Dacor-Poseidon-Other major brands. Lake Orion, MI 48035. (313) 693-2131

MINNESOTA



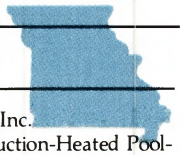
Inter-Space U.W. Photos
Capt. Ken Hafner
Isle Royale Charters
6060 5th St., N.E., Minneapolis, MN 55432
(612) 571-9003

Scuba Center
Equipment-Instruction-Repair- Dive Trips-U/W Photography. 5015 Penn. Avenue S, Minneapolis, MN 55419. (612) 925-4818

The Argonautes, Inc.
NAUI-PADI-All lines-Charter lake/sea-5000 psi. 1040 University Ave., St. Paul, MN 55104
(612) 645-0831

Club Scuba, Inc.-Pacific/Caribbean Travel
Instruction-Basic-Advanced-U/W Photography
Full Service in Repair-Hydro
East-2280 Maplewood Dr., Maplewood, MN
West-1300 E. Wayzata Blvd., Wayzata, MN
(612) 484-7252 or (612) 473-4266

MISSOURI



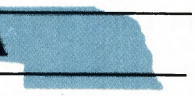
Skin-N-Scuba Dive Shop, Inc.
Sales-Service-Rentals-Instruction-Heated Pool-PADI Training Facility. 1300 W. 40 Highway, Blue Springs, MO 64015. (816) 229-0855

Hughes Dive Company
Sales-Service-Air-Rentals-Trips-Inst.-PADI & SSI-Visual Inspection-Hydros.
437 Broadway, Cape Girardeau, MO 63701
(314) 335-0756

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West End Diving Centers, Inc.
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(314) 822-3005; 11215 Nat. Bridge Rd., St. Louis MO 63044 (314) 731-5003

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Fathom Diving School (Clemens Marina)
Instruction-Sales-Repair-Air-Rental- NASDS-PADI-Excursions.
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(308) 632-3422

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Sierra Diving Center
Rentals-Air-Instruction-PADI-NAUI-Sales
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(702) 323-0353

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The Edison Skin Diving Center
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(201) 887-0194

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NAUI Instruction-Sales-Service-Dive Charters
Dive Trips-All Major Lines
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(201) 752-6050 or 752-6051

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Swim-Scuba Dive-Cross Country Ski to Acre Park-7 Acres of Water-Bar-Grill-Dive Shop-Air Station. Rt #517, Hamburg, NJ 07419
(201) 827-7630

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(609) 398-6551

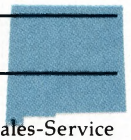
4 Divers, Inc.
Refills-Repairs-Rentals-Recovery-Salvage-PADI-YMCA. 56 Broadway, Pt. Pleasant Bch., NJ 08742. (201) 899-7753

Princeton Aqua Sports
YMCA-NAUI-PADI Inst.-Air-Sales-Rentals-Repairs-Hydros VIP-Wreck Dives/Tours.
306 Alexander, Princeton, NJ 08540
(609) 924-4240

Marlin Scuba
Air-Sales-Rentals-Repairs-Indoor heated Pool-PADI-YMCA-British Sub Aqua Inst.
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(505) 294-1886

Watersports
PADI, SSI Instruction-Dacor-Swimaster-SAS
5009 Menaul NE, Albuquerque, NM 87110
(505) 266-5218

Oceanworld Systems
Instruction-Sales-Repair-Hydro tests-Tours-Air fills. 122 Quail St., Albany, NY 12206
(518) 462-1919

NEW YORK



The Dive Shop, Inc.
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Authorized Scubapro Dealer. 3040 Avenue U, Brooklyn, NY 11229. (212) 648-4232

Wheel House Dive Shop, Inc.
PADI-YMCA-NAUI INST. 6000 PSI Air. In-house repairs-Hydro-VIP. 40' dive boat Rascal
All area wrecks-Sales-Servce-Rentals.
2917 Ave I (Off Nostrand Ave.), Brooklyn, 11210. 212-377-5303

Niagara Scuba Sports, Inc.
Local Charters-Tours-Sales-Certified Air-Rentals-Tank testing-PADI-SSI-YMCA Inst.
2048 Niagara St., Buffalo, NY 14207
(716) 875-6529

Ed's Pro Dive Shop
Sales-Service-Rentals-Air 3000 PSI-YMCA-PADI Inst. 92 Oakwood Ave., Elmira Heights, NY 14903. (607) 733-3832

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(919) 882-9726

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Scuba West Diving Schools
Cleveland's largest pro dive shop PADI classes-Air-Rentals-Service-Dive Tours.
17021 Lorain Ave., Cleveland, OH 44111
(216) 476-3199

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PADI-Rentals-Sales-Repair
425 W. McCreight Ave., Springfield, OH 45504

Diver's Paradise
Toledo's Oldest Pro Dive Shop
Basic & Advanced Inst.-Air-Sales-Service-Rental-Dive Trips. 2511 N. Reynolds, Toledo, OH 43615. (419) 535-6828

Underwater Sports of Ohio
PADI-YMCA Instruction-Air-Sales-Service-Rentals. 703 S. Main St., Urbana, OH 43078
(513) 653-5741

OKLAHOMA

Head Scuba
Full service dive shop-PADI-Basic through Asst. Inst. 6624 S. Lewis, Tulsa, OK 74136
(918) 585-5819

OREGON

Streed's Scuba Unlimited, Inc.
Sales-Service-Rentals-Instruction-Hydro tank cleaning-All major brands-NAUI-PADI-CMAS Charters and local trips. 16585 SE McLouglin Blvd., Milwaukee, OR 97222. (503) 654-9541

PENNSYLVANIA

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Scuba American, Inc.
White beautyview resort-Lake Wallentaupack PDIC-PADI-USIA-Inst.-Sales-Service- Tours. Fun diving taught by professionals.
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(717) 342-9434, 857-0234

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Scuba-America, Inc.
Full service pro shop, PADI-PDIC-USIA-Inst. White Beauty View Resort, Lake Wallenpaupack, PA. 600 E. Drinker St., Dunmore, PA (717) 342-1480 or 342-9434 or 857-0234

Anchor Line Diver, Inc.
Sales-Service-Rentals-Instruction-Dive tours. 107 Bellevue Ave., Longhorne, PA 19047
(215) 752-7442

Atlantis Diving Center
M-T-TH-F 6 p.m.- 8 p.m., Sat. 11-5; Closed Weds. & Sun.; 4363 Main Street, Manayunk, Philadelphia, PA 19127. (215) 483-8650

The Diving Bell, Inc.
Open Monday thru Saturday-Free parking on Pruyn lots. 681 N. Broad St., Philadelphia, PA 19123. (215) 763-6868

The Diving Bell, Inc.
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Professional Diving Services Co.
Pitt. area's only full time, full service dive shop. Mon. thru Sat. 10-3/6-9. 726 Pittsburgh St., Springdale, PA 15144. (412) 274-7719

York Skin Diver's Supply, Inc.
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SOUTH CAROLINA

Scuba Divers, Inc.
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(803) 221-DIVE

The Wet Shop
PADI Certification-Sales-Service-Rentals-Hydrostat-Air 5000 PSI. 5121 Rivers Ave., Charleston, SC 29405. (803) 744-9276

Wateree Diving School and Supply
PADI Institute of Advanced Diver Technology Scubapro and all major brands. 4357 Jackson Blvd., Columbia, SC 29205. (803) 787-8222

Carolina Divers Center, Inc.
Air-Rentals-Sales-Trips-Two 20' boats-PADI-YMCA Instruction-Commercial work.
North Kings Rd., Greenville, SC 29601
(803) 277-8550

Divers World Scuba Diving School
NASDS-PADI Pro Dive Store-Instruction-Tours-Sales-Service-Rentals - Wreck Diving Tours. 33031 Augusta Rd., Greenville, SC 29605. (803) 277-8659

TENNESSEE

Neptune Equipment Corporation
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TEXAS

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1447½ Grand, Beaumont, TX 77701

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Equipment: New & Used-Rentals-Air-Refills-lessons. 10634 Ferguson Rd., Dallas, TX 75228
(214) 270-9640. Hours - 10:30 to 5:30

Skindiving Schools of Fort Worth
Divers Equip. & Sup.-Pure Air-Sales-Service-Repair-Rentals-Diving Systems-Resort Travel-Salvage. 3807 SW Blvd., Ft. Worth, TX 76116
(817) 732-5761

Aqua Trek, Inc.
YMCA-NAUI-PADI Professional Instruction-Sales-Service-Trips-Planning. 804 University Blvd., Galveston, TX 77550. (713) 763-0456

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Complete dive trips-Individual or groups-to Cozumel, Caymans, Cuba. 2223 Strawberry Mall, Pasadena, TX 77502 (713) 447-0236 or 1-800-321-6760, ext. 41

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Major Brand Sales-Repairs-Scuba Tours-Rentals-U/W Photography-NAUI Inst.-Zodiac Inflatable Boat. 632 S. Central Expressway, Richardson, TX 75080 (214) 231-7865

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Northern Divers, Inc.
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Burlington, VT (802) 862-3881;
St. Albans, VT (802) 524-4097

VIRGINIA

Dad's Dive Den
Equipment Rentals-3000 Air Fills-Repairs-Testing-Inst. RFD 2, Box 211, Charlottesville, VA 22901. (804) 296-1319

Blue Ridge Dive Shop
Sales-Service-Air-Rentals-Hydro-Instr.-Pkg. deals-Commercial diving-Rock-shell shop
1726 Allied St., Charlottesville, VA 22901
(804) 293-6984

W&W Dive Shop
Sales-Service-Air-Rentals-Hydros - VIP's NAUI-YMCA-PADI Instruction.
8121 Midlothian Tpk., Richmond, VA 23235
(804) 320-0053

Underwater Outfitters
SW Va's only full time dive shop. Sales-Rentals-Repairs-Air-Dive Trips. PADI Inst. & certification. 537 W. Campbell Ave., Roanoke, VA 24016. (703) 342-DIVE

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Silent World Divers, Inc.
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Washington Divers
Washington State and British Columbia. Diving tours-Resort and Charters. Dive NW. 932 N. State, Bellingham, WA 98225
(206) 676-8029

WISCONSIN

3 Little Devils Scuba Dive Shop
Sales-Service-Lessons-Air to 4200 PSI-North entrance to Devils Lake. Rt. 4, Hwy. 123, Baraboo, WI 53913. (608) 356-5866

Fontana Army-Navy Store, Inc.
Air-Instruction-Sales-Rentals-PADI Training Facility. Hwy. 67, Fontana, WI 53125
(414) 275-2220

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Sales-Service-Air-Equip.-Rentals-Diving Inst. Super Dive Trips! 47 Shield St., Cairns, Aust. 4870 Aust. (70) 511889

Heron Island Dive Shop
Complete Barrier Reef Dive Facility. Trips-Air-Sales-PADI Instruction. Heron Isl. via Gladstone, Qld. 4680 Australia, 781488
Telex: 49455

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Underwater Explorers Society
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Victoria Inn/Scubahamas
All inclusive dive packages. Special group rates available. 40-room hotel. Dive shop on premises. Box 1261, Freeport, Grand Bahama Island.

Valentines Yacht Club & Inn
Island diving at it's best. Complete hotel and scuba facilities. Daily reef trips-instruction-pckg/group rates. Box 1, Harbour Island, Bahamas (809) 333-2142

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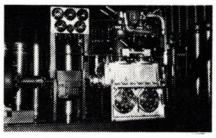


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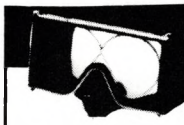
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CALENDAR

April

20-22 **NAUI Canada**
The Second Annual NAUI Canada Underwater Conference Subaquatique will be held at the Chateau Granville and the Vancouver Aquatic Centre in Vancouver, B.C. There will be U/W photo instructional seminars, equipment evaluation sessions, and an opportunity to learn how to operate a one-man submersible. For more details, contact NAUI Canada, Box 510, Etobicoke, ONT M9C 4V5.

20-22 **Adventures in Nature, '79**
Three days of films, narratives, slide shows and practical demonstrations by top names in ballooning, diving, u/w photography & cinematography, skiing, climbing, backpacking, kayaking and more. Tickets ($3.50) will be available at the door of the Tarrant County Convention Center, Fort Worth, TX. For info on retail booth space, contact Maple Leaf Productions, Box 1613, Dallas, TX 75221.

21 **NAUI Underwater '79**
National Association of Underwater Instructors' annual symposium will be held at Harvard University, Cambridge, MA, 12 to 6 pm. Contact Fred Calhoun, Box 291, Back Bay Annex, Boston, MA 02117.

21 **Jack McKenney Film Festival**
A three hour program will feature six McKenney films, including *Behind the Scenes of "The Deep,"* and Jack's new film *God's Other World, the Red Sea.* All festival profits will be donated to the Pacific Grove Marine Rescue Unit to help fund a new double lock recompression chamber. Tickets are $4.50 at local dive shops or at the door, 8 pm, Monterey Fairgrounds Agricultural Hall; or write Monterey Dive Center, 763 Lighthouse Ave., Monterey, CA 93940.

21 **NAUI Spring Film Review**
NAUI North Atlantic hosts its annual film review at John Hancock Hall in Boston, at 8 pm. Winners of the Ken Read Memorial Photo Contest will be announced; deadline for entries is April 2. Contact Alan Budreau, Box 182, Arlington, MA 02174; (617) 369-8649.

21-28 **UNEXSO U/W Medicine Program**
The Underwater Explorers Society will offer its eighth annual Basic Diving Medicine Training Program in Freeport, Grand Bahamas. 25 hours of category I AMA credit will be granted for a variety of topics including hyperbaric pulmonary physiology and special problems of saturation diving. Contact Edward Tucker, M.D., 23 S. Main St., Essex, CT 06426, (203) 767-1411.

21-28 **Physicians' U/W Medicine Program**

The Riding Rock Inn, in conjunction with Island Divers Limited located on San Salvador, Bahamas, will host this week-long academic program. Selected topics of the program focus on cardiovascular physiology, and an in depth review of the theory underlying decompression tables as well as medical problems encountered in mixed gas diving. Four authorities in the diving medicine field will serve as instructors. In addition, a complete diving program has been arranged by Lee Turcotte's Atlantis Safaris. Contact PUMP, P.O. Box 530344, Miami, FL 33153, (305) 754-7480.

May

4-6 **Our World Underwater**

More than 2000 participants are expected for the ninth annual program to be held at the Raddison-Chicago Hotel, May 4-6. Seminars, special interest presentations, how-to workshops and films on scientific endeavor, exploration, adventure and research will be included in the 46 hour program. After dark activities include the Scholarship Banquet to award the OW-U Scholarship, more films, and poolside parties Friday and Saturday nights at the 16th floor pool. For info on individual or block ticket prices, contact Our World Underwater IX, Tickets, Box 4428, Chicago, IL 60680.

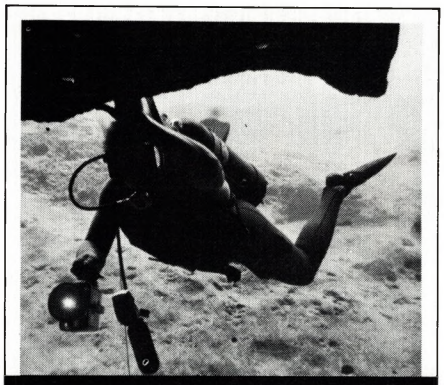
5-12 **UNEXSO U/W Medicine Program**

The Underwater Explorers Society will host the 13th International Physicians' U/W Medicine Program in Advanced Cardiac Life Support (Provider Level) at the Society's headquarters in Lucaya, Bahamas. Providing a basic approach to recognition and management of hyperbaric trauma, the 27 hour program will culminate in Provider Level Certification in Advanced Cardiac Life Support. A descriptive brochure is available from: PUMP-ACLS, Box 530344, Miami, FL 33153.

12 **UPS Film Festival**

The Underwater Photographic Society, Northern California Chapter, will sponsor the fifteenth annual International U/W Film Festival at the Paramount Theatre of the Arts in Oakland. Drawing entries and exhibitors from all over the world, the annual event is the oldest underwater film festival in the US. Deadline for contest entries is April 20. Write the Underwater Photographic Society, c/o Rich Bergero, 22430 Thunderbird Place, Hayward, CA 94545.

continued



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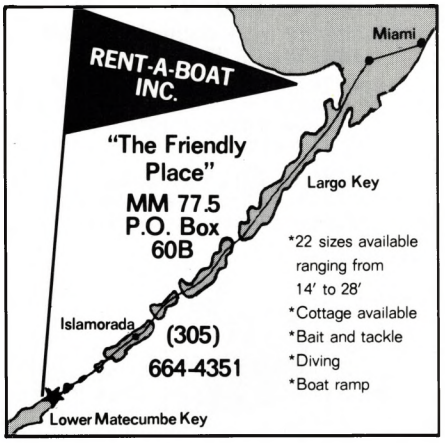
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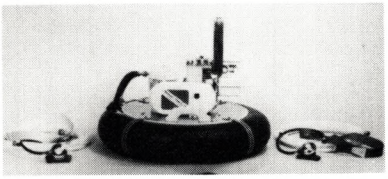
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CALENDAR *continued*

Planet Water '79

Celebrating its success on the road, the underwater film program Planet Water '79 will tour 20 major cities throughout the U.S. this year.

Presented under the sponsorship of *Sport Diver* Magazine, the Bahamas Ministry of Tourism and Nikon Cameras, Planet Water's executive producer Dan Conaway of Omorka Travel Services says Planet Water will attract audiences of up to 3000 per showing.

The emcee will be Rick Frehsee, who in addition to his regular contributions to *Sport Diver* Magazine, is well known for his editorial and advertising work published worldwide. Rick will present the *Deadly Fathoms*, a film which documents the atomic graveyard at Bikini Lagoon.

Several of Robin Lehman's films will be shown. Lehman, who directed *I Am the Sea*, has received several Academy Award nominations for his films.

Joining Rick at the podium will be Richard Stewart or Steve Blount from *Sport Diver* Magazine, who will present some of the magazine's best photography. Dan Conaway will present Paul Tzimoulis' slides of the Bahamas, and Rick will show a message presentation called *Diving Is*.

The original Cousteau black-and-white classic, *Silent World*, a 1979 fashion and product review and the Planet Water Theme Presentation will round out the evening.

The cities firmly scheduled for 1979 include:

Greensboro, NC—April *20*
Detroit, MI—April *21*
Albany, GA—April *28*
Charleston, SC—April *29*
Atlanta, GA—May *18*
Tallahassee, FL—Oct. *20*
Rockford, IL—Nov. *9*

Dates for the scheduled shows in Miami, Florida; Birmingham, Alabama; Chattanooga, Tennessee; Indianapolis, Indiana; Dallas, Texas; Rochester, New York and Bogota, Colombia have not yet been announced. A special presentation of Planet Water will be made at the NAUI IQ-11 program in Houston, Texas this fall.

The Planet Water show is still available to local sponsors at an affordable fee. The package includes the film show, presenters fees and expenses, full color posters, vacation giveaways, advertising and promotional material, photo salon display and optional photo clinics, socials and T-shirt printing.

Watch for the Planet Water program in your area. It will be one of the diving world's great social events of the year.

For more information contact Dan Conaway, P.O. Box 76721, Atlanta, GA 30328 or call (404) 428-1588.

13 **Divers' Day at Marine World**
In joint sponsorship with the Central California Council of Diving Clubs, Marine World—Africa USA invites divers to their 65 acre Marine Life Show Park for a day of shows, attractions and special events for divers. Oceanarium exhibits will be open from 9:30 am to 6 pm. Write Divers' Day Committee, 3673 Bassett Ct., So. San Francisco, CA 94080.

18-20 **YMCA Convention**
Key West will be the site of the National YMCA Underwater Activities Convention at the Casa Marina Inn. Activities will include exhibits, art and photographic shows, presentation of technical papers, a snorkeling treasure hunt, film festival, oceanside party and a breakfast divewear fashion show. National YMCA Center for Underwater Activities, Box 1547, Key West, FL 33040.

19-20 **Seaspace '79**
Seaspace '79—A Space for Man, an international underwater film festival sponsored by the Houston Underwater Club, will be held at the University of Houston. The two day symposium will include a photo contest, two performances of the film festival, and evening social activities. Deadline for photo competition entries is April 25. Write Dick Zingula, Box 4362, Houston, TX 77210.

26-31 **Photo Instruction Seminar**
Leach Photo systems will sponsor a Photo Instruction seminar at the Cape Eleuthera Resort, Cape Eleuthera, Bahamas. Instructors Steve Frink and Steve Lucas will cover equipment use and selection and photographic techniques. Leach Photo Systems, P.O. Box 846, Encinitas, CA 92024.

June

2-9 **Physicians' U/W Medicine Program**
Ocean Divers, Inc. will co-host the 14th International Advanced Physicians Underwater Medicine Program at the Holiday Inn in Key Largo. Academic instruction will focus on cardiovascular physiology as it is related to the diving environment. For a free brochure, write PUMP, Box 530344, Miami, FL 33153.

9-10 **Treasure Hunt '79**
Groping beneath the cool surface of Lake Ontario, more than 600 divers are expected to attend the eighth annual Sub Mariner Diving Equipment Treasure Hunt in Toronto. More than 200 prizes will be awarded the lucky divers who find and retrieve weighted flags concealed on the lake's bottom. Sub Mariners Diving Equipment, 954 Wilson Ave., Downsview, Ontario.

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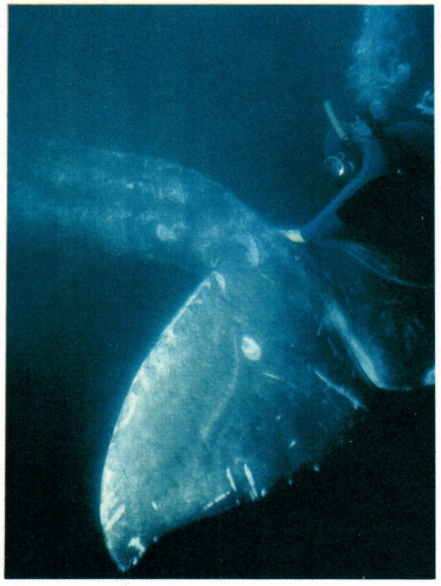
Reflections in a tennis-ball-size eye.

BY HOWARD HALL

It was a late afternoon in January when Larry Cochrane and I entered the kelp forest near San Diego. Water conditions were typical for that time of year. The bottom was 60 feet below the boat with about 20 feet of visibility. Larry and I were 15 feet below the surface, swimming toward the edge of the kelp. I knew that, once inside, it would be quite dark. I hesitated outside the forest to check the focus and shutter speed on my Nikonos. When I glanced over at Larry, I noticed that he had stopped also, waiting for me, not wanting to go into the kelp alone. Cold, dark water in murky kelp forests is always a little spooky, but that's not the reason my heart rate was over 140. Just inside the dark forest ahead of us was a creature whose weight is measured not in pounds, but in tons. Larry and I were about to be among the few who have seen a gray whale underwater.

One of the most awesome experiences of my life was swimming through that dark kelp forest, waiting for a whale to suddenly appear within our 20-foot visibility. It was obvious that we wouldn't be able to see the entire animal at once, and I wondered what I would see first. Would I find myself swimming into a dark cave only to have the great jaws close around me, and be swallowed like Jonah? Or would huge flukes rush up from the murk to crush me? I told myself that whales are friendly and wouldn't harm someone needlessly. But I have stepped on ants and crushed them without meaning them any harm. I hoped this whale was less clumsy than I.

Suddenly the shadows changed ahead of me and the whale appeared. It passed through the kelp like a moving reef, fronds of kelp snapping easily as they caught on the whale's pectoral fins.



By the time I had raised my camera, the animal's head was between us. Its face was covered with barnacles the size of silver dollars and when it opened its mouth slightly I could see the white baleen within. I felt its eye looking at me. The eye was huge, the size of a tennis ball, but looked tiny below the whale's enormous brow. The whale jumped slightly the first time my strobe went off, but did not seem to quicken its swimming. I had time to take five or six photographs as the animal passed by. When the face had disappeared the body was still going by and I found myself taking photographs of a huge gray wall. I thought to myself that photos of a gray wall may not be very useful, and that I should get ready to photograph the tail. Then I realized I was in the path of the whale's flukes. Before I had time to move, the flukes were passing within inches of my camera. On the other side, I saw Larry reach out and touch the whale's tail before it disappeared.

Larry and I spent all afternoon and evening with the animal. We would approach it underwater and swim beside it with all our strength, tearing kelp from our gear as we tried to keep up with the whale's effortless movements. After being left behind, we would swim across the kelp to the boat, move it, tie off to the kelp again, and be back in the water with the whale for another brief encounter. By the end of the day, we were both exhausted.

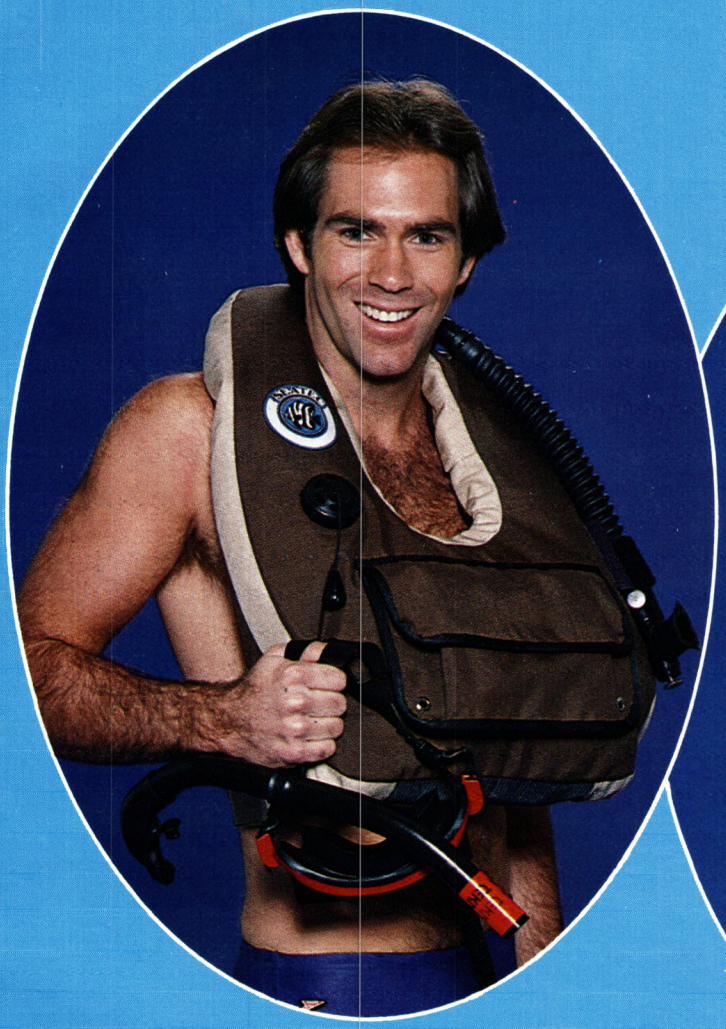
It had been unusual enough to see a gray whale underwater, but Larry and I observed something that made the experience even more unusual. The whale had been in the kelp for a reason—it was eating kelp. Now, any authority can tell you that whales don't eat kelp. Most biologists can demonstrate to you there is no nutritional reason why a whale would want to eat kelp. And most gray whale experts will tell you that grays don't eat anything during migration. But this whale was unaware of these expert opinions. Larry and I saw the whale repeatedly take great quantities of kelp into its mouth and chomp it to bits. Occasionally, the whale spat out large amounts of broken kelp. And while I photographed kelp being eaten, Larry was at the other end, photographing the kelp coming out. Later the photographs proved that this whale was, in fact, eating kelp. The reason remains a mystery.

After the sun had gone down that January evening in 1975, Larry and I crawled into the boat for the trip home. It was a beautiful sunset and neither of us was anxious to get back to the dock. We were content to move slowly up the coast and reflect on the day's experience. Diving can be cold, uncomfortable, unglamorous, and when pulling on a cold, clammy wet suit, the smell is appalling. But isn't it magnificent that within a stone's throw of one of the country's largest population centers you can strap on a few pounds of equipment, slip under the surface and be on the edge of the greatest frontier on Earth, where creatures like gray whales pass unobserved every day?

I leaned back in the padded seat of the boat, took another swallow from the bottle of Tyrolia and decided that diving isn't a sport; it's a way of life.

Undersea photographer/author Howard Hall is an instructor of underwater photography and has been involved in the filming of various motion pictures, including ***The Deep.***

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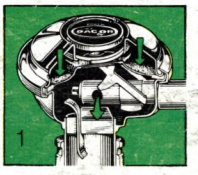
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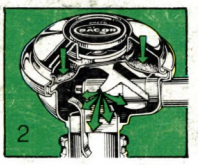
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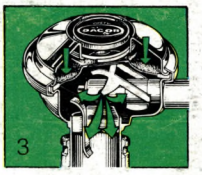
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